FINANCIAL SERVICES REVIEW

Financial Services Review 18 (2009) 105–122

Cost efficiencies and the selection of closed-end funds

D.K. Malhotra,[a,*] Rand Martin,[b] Robert W. McLeod[c]

[a]*Department of Finance, Philadelphia University, School of Business Administration, Philadelphia, PA 19144-5497, USA*
[b]*Department of Finance and Legal Studies, College of Business, Bloomsburg University of Pennsylvania, Bloomsburg, PA 17815-1301, USA*
[c]*Department of Finance, The University of Alabama, Economics, Finance, and Legal Studies, Tuscaloosa, AL 35487, USA*

Abstract

Over the last decade, the amount of assets under management in closed-end funds (CEFs) has almost doubled whereas the number of funds has increased by only about 26%. For investors who use CEFs in their portfolios, it is important to understand whether this growth provides benefits through the existence of economies of scale. To aid individual investor in fund selection, this study provides an insight into the determinants of cost efficiencies in the CEF industry for the period 1995 to 2005. Empirical results show that cost increases in the United States CEF industry have been less than proportionate to increases in assets, which points to economies of scale for the industry. Furthermore, the average cost elasticity varies with fund size and investment objective.

JEL classification: C51; G20; G23

Keywords: Closed-end funds; Cost-efficiencies; Economies of scale; Expense ratios

1. Introduction

The objective of this research is to aid individual investors in the selection of closed-end funds (CEFs) by determining if economies of scale exist and, if so, what factors contribute to these economies. First, the motivation for our study is based on our finding that there has been no prior research on the factors that give rise to economies of scale for CEFs. Second,

* Corresponding author. Tel.: +1-215-951-2813; fax: +1-215-951-2652.
E-mail address: MalhotraD@philau.edu (D.K. Malhotra)

1057-0810/09/$ – see front matter

we believe that CEFs are an important area for research because assets under management have almost doubled from $143 billion in 1995 to $276 billion in 2005 whereas the number of CEFs has increased from 500 to 634.[1] With this growth in assets relative to the growth in the number of CEFs, investors might expect that individual funds would achieve economies of scale for certain levels of assets and/or perhaps because of other factors in the administration and management of the fund.

From the investors' perspective, economies of scale are important in lowering the expense ratios of investment companies. Because a number of studies argue that expenses have a direct impact on a fund's return to its investors, then, if economies of scale exist, with every increase in fund size, fund expenses as a percentage of assets will go down and the return to investors will increase.[2]

Furthermore, recent studies on open-end funds (OEFs) show that individual investors are more aware of fund expenses and net fund flows are influenced by fund costs.[3] Studies by Sirri and Tufano (1998); Siggelkow (1998, 2003); and Nanda, Wang, and Zheng (2000) find the impact of higher fund expenses and loads on net flows is negative. Barber, Odean, and Zheng (2003) find that investors are less likely to buy funds with high operating expenses (other than fund marketing expenses). Similarly, Khorana and Servaes (2004) find that fund investors generally avoid fund families with high objective-adjusted fees. They also find that families have a higher market share within an objective when they charge lower fees in conjunction with better performance and innovation. Therefore, it is important that investors pay attention to fund management costs.

With the rapid growth in the fund industry and with the increase in the number of CEFs in the market, mergers among CEFs are fast emerging as a new phenomenon to achieve lower cost of managing a fund because of economies of scale. As argued by Jayaraman, Khorana, and Nelling (2002), with mergers, the excess supply of individual funds in the market can be reduced and there can be gains from lower cost of managing a fund because of economies of scale.[4] This study will provide investors with a better understanding of the impact of fund mergers and size on fund expenses and its benefits to fund shareholders in the form of higher returns and increased shareholder wealth.[5]

Because CEFs usually do not sell more shares after the initial public offering, their expense ratios may be seen as relatively fixed and will decline only if the market values of the securities in the fund increase.[6] Despite limits on growth through share issuance, there are reasons to believe that economies of scale may exist for CEFs. Investors should look to see if the CEF is in a *fund family*. Sirri and Tufano (1993) show that *fund families* may be able to achieve economies of scale in several activities. By spreading fixed costs over a larger asset base, funds can achieve economies of scale in maintaining shareholder records. Cost efficiencies in variable costs also can be realized in security transactions and in administering back-office functions to execute security trades. In addition, a fund complex could achieve scale economies in investment selection by getting the "best price" for a security and by spreading the cost of financial research over a large asset base.[7]

We distinguish our study from previous studies in two ways. The first of these is the length of time for which the study is done. Previous published studies of economies of scale in the U.S. mutual fund industry by Collins and Mack (1997) and Latzko (1999) find significant economies of scale. In a study of the French mutual fund industry, Dermine and Roller

(1990) also find economies of scale for small to medium sized fund complexes. The Collins and Mack (1997) study uses data for only one year (1994) to study economies of scale. Similarly, Latzko (1999) uses data for 1997 alone to study economies of scale. No study has looked at economies of scale over a longer period of time. Because we study economies of scale over a period of 11 years (from 1995 thorough 2005), we are able to investigate the consistency of economies of scale over a longer period of time.

Secondly, we contribute to the literature by adding a new dimension to the determinants of fund economies of scale by introducing a new variable, fund concentration, or fund focus. Some fund families spread their fund offerings across investment objectives, whereas others focus within them. Sigglekow (2003) reports that funds in focused families offer investors better returns. He attributes this better performance to lower marketing and distribution costs for focused funds. Ciccotello, Miles, and Walsh (2006) attribute this performance to economies in security selection research expenditures. CEFs do not have marketing and distribution costs, but economy in security selection expenditures may be applicable to them. We investigate the impact of fund focus on CEF management costs and consequent economies of scale.

This paper has six sections. Section 2 is a discussion of previous research related to this topic. Section 3 briefly describes our data. Section 4 describes our methodology and gives information on CEF expenses. Section 5 presents our empirical results. Section 6 gives our conclusions.

2. Previous research

Although there have been extensive studies of economies of scale in other industries, the research on economies of scale of investment companies is relatively new and generally focused on open-end investment companies (mutual funds). Baumol, Goldfeld, Gordon, and Koehn (1990) find significant economies of scale in the mutual fund industry in the mid-1980s. Dermine and Roller (1992) report economies of scale for small to midsized French fund complexes, with scale economies vanishing for the largest French complexes. Studies by Ferris and Chance (1987); Trzcinka and Zweig (1990); Chance and Ferris (1991); McLeod and Malhotra (1994); and Malhotra and McLeod (1997) analyze expense ratios of OEFs. These studies conclude that larger funds have lower expense ratios and this result is attributed to economies of scale. Collins and Mack (1997) determine the optimal mutual fund size for the creation of economies of scale. Latzko (1999) reports economies of scale for mutual funds for the year 1997. Malhotra, Martin, and Russel (2007) study economies of scale over a period of six years from 1998 to 2003. They find that simply being a part of a large family does not reduce dollar cost of fund management, but if the family is focused on a few objectives, it reduces the fund management costs.

The extant research on economies of scale of CEFs is rather limited. A study by Malhotra and McLeod (2000) using data from 1989 to 1996 examines the cost structure of CEFs using regression analysis and reports that larger CEFs have lower expense ratios. They argue that this result may be because of economies of scale in the CEF industry, but did not investigate the reasons for economies of scale.

3. Data

Our data set is taken from *Morningstar Closed-End Funds and Principia for Closed-End Funds*. The data set covers the years 1995 through 2005. Our annual data for each fund includes investment objective, assets under management, expense ratio, premium, or discount of share price from net asset value (NAV), NAV total return, standard deviation of NAV return, asset turnover ratio, age of the fund, and manager's tenure. We also use the information given in the *Morningstar Principia* to compute number of funds in a fund family and the degree of concentration (fund focus) within the family. Fund focus or concentration is defined as the extent to which a fund family is focused on an investment objective within the family.

Eq. (1) shows the method that we use to compute fund focus within a fund family.

$$\textit{Fund Focus} = \frac{\textit{Number of Funds in Family} - \textit{Number of Fund Objectives in Family}}{\textit{Number of Funds in Family}} \quad (1)$$

The fund focus variable varies between zero for the lowest fund focus and less than 1.00 for the highest fund focus. If a large fund family concentrates on offering a limited number of fund objectives within the family, fund focus/concentration will be higher. The dollar cost of managing a fund is computed by multiplying the expense ratio with the asset size of each fund. These data are summarized in Table 1.

Trends in the data can be observed in Table 1. On average the amount of assets being managed by a CEF family in 2005 more than doubled since 1999. The number of funds in the family has also gone up significantly from a low of 17.25 in 2002 to 44.77 in 2005. Another trend that is noticeable in our data is an increase in fund focus over the years. Fund concentration hovered in the mid 0.50s through 2002, but after that fund, concentration has been rising and is now closer to 0.70. If we look at the median for number of funds in the family, assets managed by a fund family, and fund focus, we find that median size of assets managed by a CEF family is almost half of the mean size, which shows skewness because of some fund families being very large and pulling up the average; median number of funds in the fund family also shows a significant jump from 9 in 2002 to 28 in 2005. When we look at median size of fund family assets and number of funds in a family along with the fund focus, it only confirms that we have some very large focused CEF families. For instance, Nuveen Advisory is offering 56 funds with a total asset base of $19,762 million and a fund focus of 0.93. In 2003, Nuveen's fund offerings increased to 93 with a total asset base of $26,686 million, and fund focus increased to 0.98. This explains a big jump in funds per family in 2003 in comparison to 2002. By 2005, Nuveen's total fund offerings increase to 111 CEFs with a total asset base of $34,414 million and fund focus of 0.95.

The dollar amount of costs incurred by CEFs has been quite stable throughout the sample period and has not gone up significantly since 1995. Finally, the three-year annualized standard deviation of returns shows a decline since 2001. Interestingly, share price discounts from NAV reach a peak in 1999. Perhaps this was a harbinger of things to come in the markets.

Table 1 Descriptive statistics for the variables used in this study

		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
Assets by fund	Mean	304.8	293.51	271.25	260.27	293.22	303.15	304.28	279.20	286.05	269.22	301.30	285.89
($MM)	Median	190.77	182.3	153.95	148.4	167.6	178.8	182.35	176.7	159	169.8	173.05	169.4
	SD	342.33	329.98	506.72	351.16	378	384.87	378.48	316.23	284.33	323.80	370.27	371.27
Assets by	Mean	6388.57	6504.71	4924.90	5093.29	6496.18	6058.47	6250.579	5279.999	9369.30	14052.63	13940.71	7470.12
family	Median	2773.87	3209.1	2787.8	2874.9	2877.4	2661	2567.7	2132.05	4358.8	5696.6	7170.8	3576
($MM)	SD	8182.22	8036.41	5789.01	6044.67	8244.44	8110.73	8367.191	6635.345	11206.74	14486.74	13328.48	9539.72
Age (years)	Mean	8.11	7.69	8.41	9.40	10.53	11.54	12.60	13.40	12.48	13.47	12.72	10.66
	Median	6	5	6	7	8	9	10	11	11	13	13	9
	SD	9.68	8.83	8.86	8.81	9.07	9.21	9.40	9.33	7.00	8.05	8.86	9.16
Dollar cost	Mean	3.24	3.54	3.04	2.77	3.08	3.34	3.34	3.13	3.32	3.29	3.36	3.21
(in millions)	Median	2.15	2.28	1.84	1.83	1.98	2.18	2.23	2.05	1.95	2.02	1.99	2.03
	SD	3.38	3.84	5.69	3.25	3.58	3.88	3.78	3.60	2.87	4.55	4.04	4.03
Number of	Mean	19.62	19.46	18.40	19.33	20.45	17.90	17.75	17.25	33.93	46.42	44.77	24.36
funds in	Median	11	13	11	11	11	11	10	9	17	31	28	13
family	SD	20.23	18.8	18.33	18.911	20.11	18.32	18.54	18.75	37.78	44.30	43.77	28.11
Fund	Mean	0.53	0.56	0.55	0.51	0.52	0.52	0.51	0.50	0.66	0.69	0.64	0.56
concentration	Median	0.6	0.63	0.57	0.56	0.56	0.56	0.56	0.56	0.75	0.76	0.68	0.63
	SD	0.34	0.33	0.32	0.32	0.32	0.31	0.32	0.33	0.28	0.27	0.29	0.32
Premium/	Mean	−7.6	−7.55	−2.89	−3.45	−12.93	−9.14	−4.18	−3.07	−0.58	−5.53	−2.27	−5.57
discount	Median	−9.27	−8.2	−4	−2.3	−13.8	−9.8	−4.45	−4.1	−2.10	−7.55	−3.6	−6.3
	SD	8.4	8.28	10.84	11.20	8.94	9.16	8.83	9.69	7.56	7.27	8.52	9.81
NAV return	Mean	10.10	6.40	12.36	6.96	6.17	4.02	3.56	2.13	8.59	9.17	11.03	7.82
annualized 3	Median	9.59	5.67	12.97	7.35	4.26	4.62	4.1	7.23	8.18	8.32	7.02	7.11
years	SD	4.85	6.10	11.21	9.47	9.35	7.23	6.98	11.63	3.59	3.98	11.12	10.27
Turnover	Mean	68.03	72.84	70.53	71.06	67.89	55.81	55.42	57.04	54.95	45.06	38.02	60.60
ratio (%)	Median	37.5	46	44	44	42	34.5	35	33	26	22	19	35
	SD	94.06	85.56	80.72	87.95	87.59	71.23	70.19	74.87	75.39	63.29	49.38	79.66
3-Year	Mean	10.08	10.45	10.07	11.94	13.73	14.1	12.8	10.86	9.22	8.38	7.79	10.95
annualized	Median	8.14	9.1	7.27	5.81	5.65	6.39	6.78	7.49	7.52	7.63	7.15	7.13
SD (%)	SD	7.30	6.38	7.78	12.19	16.71	16.74	14.53	7.927	5.72	4.55	3.95	11.00

The sample contains a total of 4,196 observations for the years 1995 through 2005. Data are based on year-end December 31 *Morningstar Principia* closed-end fund data. SD – standard deviation.

4. Methodology

Investment company expenses are the result of a hybrid relation between the management company and a fund. Usually, the management company is the creator, promoter, and manager of the fund, and undertakes these activities in the hope of generating profits once the fund reaches a sustainable level of assets.

Organizing a fund involves substantial costs that include legal, accounting, distribution, and regulatory fees. These costs are absorbed by the management company and usually exceed the fees that are paid by shareholders in the first few years of the fund's existence. Because these start-up costs put the management company's capital at risk, the receipt of fees is considered as compensation for the entrepreneurial risk of starting the fund. Thus, management expenses represent the compensation for services rendered and for the entrepreneurial risk assumed.

The annual expense ratio expresses the percentage of assets deducted each fiscal year for fund operating expenses, including management fees, administrative fees, operating costs, and all other asset-based costs incurred by the fund. The main cost in CEFs is typically the advisory fee. The source of economies of scale for CEFs may be the advisory fee, because some CEFs might have "break points" in the advisory fee. Rather than breakpoints, it could be possible that the independent directors negotiate lower advisory fees over time as a particular fund grows. Therefore, a given fund might not have break points, but might have a lower advisory fee in terms of basis points over time.[8] For instance, Nuveen's single state muni bond fund (with an expense ratio of 0.83%) lists advisory fees as 0.45% for the first $125 million, 0.4375% for the next $125, 0.4225% for the next $250 million, and 0.4125% for the next $500 million in assets. Therefore, as the size of the fund rises, advisory costs are on the decline, resulting in economies of scale and reduced cost of fund management for the fund.

The other set of CEF expenses are administrative fees. These would typically include director's fees, auditing/accounting fees, other professional fees, custodian fees, reports to stockholders, transfer agent fees, and other similar fees. Many of these expenses do not increase in the same proportion as the fund's assets increase. For instance, audit costs do not increase in the same proportion as a fund grows. Therefore, there are reasons to believe that there are economies of scale in the management of CEFs.

To investigate economies of scale in CEFs, we use a two-part methodology. The first part is an estimation of the coefficients for a translog cost function to determine which factors contribute to economies of scale and the extent to which they contribute for each of the 11 years for the period 1995 through 2005. The second part is an estimation of the coefficients for a translog cost function using panel data approach. The panel data approach allows for pooling of observations on a cross-section of CEFs over 11 years. When observations possess this double dimension (cross section and time series), the crucial aspect of the analysis is to have a clear understanding of how in this case, differences in behavior across individual funds and/or through time could and should be modeled. A panel data set offers a certain number of advantages over traditional pure cross section or pure time series data sets. The most obvious advantage is that the number of observations is typically much larger

in panel data, which will produce more reliable parameter estimates and, more importantly, enables us to test the robustness of our linear regression results.

The use of panel data also alleviates the problem of multincollinearity. When the explanatory variables vary in two dimensions (cross-section and time series), they are less likely to be highly correlated. In addition, panel data sets make it possible to identify and measure effects that are simply not detectable in pure cross section or pure time series data. For instance, sometimes it is argued that cross section data reflect long-run behavior, whereas time series data emphasize short-run effects. By combining the cross-section and time series features of a data set, a more general, and comprehensive dynamic structure can be formulated and estimated. Panel data suggest that individuals, firms, states, or countries are heterogeneous (Balestra 1995). Time series and cross-section studies not controlling for this heterogeneity run the risk of obtaining biased results (Baltagi 2000). Panel data controls for individual heterogeneity.

The most intuitive way to account for individual and/or time differences in the context of panel data regression problem is to assume that some of the regression coefficients are allowed to vary across individual and/or through time. The regression coefficients are unknown, but fixed parameters. When these are allowed to vary in one or two dimensions, it is called a fixed effect model. We use a fixed-effect model to estimate economies of scale in CEFs.

4.1. Translog cost function

In financial economics, the translog model[9] is the most pervasive approach for investigating economies of scale.[10] The translog cost model implicitly assumes the U-shaped average cost function. It is used here because it allows economies of scale to vary with level of fund assets.

The estimation of scale economies with a translog cost function requires cost and output measures. For CEFs, the outputs are total assets under management. Total cost of each CEF is defined as the total expenses of operating the funds and includes management fees. A fund's total operating expense is modeled as a function of total assets and control variables that affect level of expenses.

Eq. (2) is the translog cost function used in this study. Ordinary least squares (OLS) regression is used to estimate coefficients of the independent variables.

$$\text{Ln COST} = \beta_0 + \beta_1 \ln \text{ASSETS} + \tfrac{1}{2}\beta_2(\ln \text{ASSETS})^2 + \Sigma_j \beta_j X_j + e \qquad (2)$$

In the translog function, COST is the dollar amount of a fund's total operating expenses, ASSETS is total fund assets, and X_j includes control factors that affect the costs of management and administration of a CEF.

Our control variables and reasons for selecting them are as follows.

Age: Chance and Ferris (1990), Ferris and Chance (1987), McLeod and Malhotra (1994), Malhotra and McLeod (1997) observe that an older fund is expected to have lower costs, because as funds get older they learn from their past mistakes and become more efficient in managing costs. Thus, we expect a negative coefficient for fund age.

Bond: Malhotra and McLeod (1997) argue that bond funds on an average carry a lower

expense ratio in contrast with equity funds. We include a dummy variable that is assigned a value of 1 if the fund belongs to a bond fund class, 0 otherwise.

Concentration (Fund Focus): We include fund focus as one of the variables that will influence fund management costs. Previous research shows that focused OEFs can attain economies of scale through lower marketing and distribution costs (Sigglekow, 2003) and through better security selection (Ciccotello, Miles, and Walsh, 2006). CEFs do not have marketing and distribution (12b-1) expenses, because they do not have to attract fund flows from investors. If they want additional funds after an initial public offering, normally they go through underwriters. Ciccotello, Miles, and Walsh (2006) report that focused open-end equity funds attain economies of scale through economies in security selection expenditures. Fund focus is a function of the number of funds in the family as well as the number of fund objectives offered by that particular fund family. Thus, the degree of focus will be higher for a smaller number of fund objectives offered within a fund family. We hypothesize a negative relation between fund focus and fund management costs.

Fund Family: We add assets in a fund family to account for the fund family size as a control variable. Gaspar, Massa, and Matos (2005) argue that fund families reap benefits of economies of scale and scope in areas such as research, trading, and execution, and investor search and distribution costs. Collins and Mack (1997) find economies of scale for bond as well as equity fund family complexes. Khorana and Servaes (1999) point out that the potential to exploit economies of scale is an important factor that fund families keep in mind to originate new funds within the family. A fund family should be able to reduce expenses since it is incurring them for a group of funds rather than for each fund separately. Membership in a family of funds should thus create economies of scale. We expect this variable to have a negative regression coefficient.

International: Malhotra and McLeod (2000) argue that international CEFs on an average have a higher expense ratio because of higher information collection costs. We include a dummy variable that is assigned a value of 1 if the fund's prospectus objective is international, Europe, Pacific, Latin America, or World.

Net Asset Value Total Return is a control variable, because size of return and fees paid to most fund advisors are related. Usually, proponents of higher fees argue that you get what you pay for. Higher returns may warrant higher fees, which would increase fund expenses. So, the coefficient of this variable is expected to be positive.

Premium or discount of sales price from net asset value per share is included because studies by Crawford and Harper (1985), Anderson and Born (1987a, 1987b), Kumar and Noronha (1999), and Malhotra and McLeod (2000) have shown that it is positively related to fund costs. The greater the discount from net asset value, the greater the expected fund costs. On the other hand, the greater a premium from net asset value, the lower the expected costs. A positive coefficient is expected.

Three-year annualized standard deviation of returns is a control variable, because when a fund incurs high costs, the fund manager in many cases will take greater investment risks to recover these costs. Thus, we expect funds with more volatile returns to have higher expenses. A positive coefficient is expected.

Turnover ratio of the fund is a control variable for obvious reasons. Index funds have the lowest turnover ratio and the more actively managed the fund, the higher the turnover ratio.

Connelly (1997) and Fortin and Michelson (1998) report that a fund's turnover ratio positively influences fund expense ratio. As such, a fund's expense ratio should be higher if turnover in the portfolio is higher and a positive regression coefficient is expected.

4.2. Cost elasticity

The most common measure of operating efficiency in economies of scale studies is the elasticity of cost with respect to the output. When the rate of increase in output exceeds the rate of increase in cost in an industry, economies of scale characterize the industry. Cost elasticity with respect to assets can be used to evaluate the existence and the extent of economies of scale in CEF administration. It is measured by percentage change in cost associated with a percentage change in fund assets. We calculate this elasticity by taking the first derivative of the translog cost function (Eq. (2)) with respect to assets. The result is Eq. (3).

$$\partial\,(\ln \text{COST})/\partial(\ln \text{ASSETS}) = \beta_1 + \beta_2(\ln \text{ASSETS}) \tag{3}$$

If cost elasticity is less than one, CEF expenses increase less than proportionately with changes in fund assets. This implies that economies of scale exist. If the elasticity is greater than one, diseconomies of scale exist.

To estimate the existence of economies of scale, we use the "average" method suggested by Noulas, Ray, and Miller (1990). The average method requires estimating the scale economy measure for each observation (fund) and then averaging across observations to arrive at the group scale economy measure.

We estimate cost elasticities for the total group of funds in each annual sample. We also estimate elasticities for groups within each annual sample where the groupings are according to fund size and fund objective.

5. Empirical results

5.1. Cost function

Regression results including the panel data fixed effect model analysis for the translog function are reported in Table 2. Some of the results are as expected, whereas others are not.

The adjusted R^2 from Table 2 is large for all 11 years as well as for the panel data, which means that the translog cost function is well specified for explaining economies of scale. The R^2 values show that the cost function explains 84% to 92% of the variability of fund costs about the mean over the 11-year period. Of interest to the CEF investor is the relation between the variables and fund costs. Table 2 shows that the natural logarithm of assets, international funds, and three-year annualized standard deviation have a consistent positive impact on fund costs, whereas membership in a fund family and age of the fund have a consistent negative impact on fund costs throughout the sample.

For all of the 12 (including panel regression) regressions, the average cost elasticity for the

Table 2 Regression results for the translog cost function

Variables		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	1995–2005 (panel data)
Adjusted R^2		0.88	0.84	0.89	0.89	0.89	0.89	0.89	0.88	0.91	0.90	0.92	0.88
N		332	443	448	441	427	396	376	354	315	294	370	4196
International	Coefficients	0.19	0.18	0.25	0.13	0.15	0.09	0.25	0.14	0.11	0.02	0.17	0.23
	t-Statistics	2.47*	2.39*	3.13*	1.78***	2.19**	1.33	3.52*	1.82***	1.03	0.26	2.24**	11.08*
Bond	Coefficients	0.08	0.28	0.14	0.06	0.01	0.01	−0.01	−0.05	0.03	0.07	0.04	0.07
	t-Statistics	1.56	5.59*	2.95*	1.34	0.36	0.34	−0.33	−0.98	0.32	1.14	0.68	5.19*
Fund concentration	Coefficients	−0.01	−0.07	0.04	0.13	0.03	0.01	0.14	0.10	0.08	0.03	−0.08	0.02
	t-Statistics	−0.10	−0.82	0.55	1.65***	0.36	0.18	1.76***	1.17	0.88	0.30	−0.88	1.00
Fund family	Coefficients	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
	t-Statistics	−4.63	−3.72*	−4.44*	−4.51*	−4.38*	−2.65*	−4.49*	−3.73*	−2.61*	−5.45*	−3.59*	−14.19*
Premium/ discount	Coefficients	0.003	0.01	−0.00	−0.00	0.001	−0.01	0.00	−0.001	0.01	0.005	−0.002	0.00
	t-Statistics	1.51	0.83	−0.32	−2.28**	0.82	−2.81*	0.73	−0.54	4.15*	1.69***	−1.18	0.109
NAV total return	Coefficients	0.00	0.01	0.001	0.00	−0.002	−0.01	−0.002	0.002	−0.003	0.003	0.00	0.008
	t-Statistics	0.80	1.85***	0.82	0.37	−1.17	−3.94*	−0.64	0.90	−1.60	0.34	0.15	1.57
Ln of assets	Coefficients	0.82	0.89	0.91	0.80	0.63	0.64	0.62	0.64	0.96	0.88	0.82	0.78
	t-Statistics	4.84*	5.10*	10.22*	8.11*	6.54*	5.60*	4.91*	5.16*	7.33*	5.59*	7.04*	21.31*
½ (Ln of assets)^2	Coefficients	0.02	0.01	0.005	0.02	0.05	0.05	0.06	0.05	0.003	0.02	0.03	0.03
	t-Statistics	0.74	0.44	0.28	1.11	2.90*	2.39*	2.40*	2.08**	0.13	0.77	1.21	4.34*
Standard deviation 3 years	Coefficients	0.011	0.02	0.01	0.01	0.01	0.01	0.006	0.02	0.04	0.03	0.01	0.01
	t-Statistics	2.94*	5.94*	4.53*	4.81*	6.46*	5.69*	3.87*	5.75*	9.21*	3.71*	1.37	14.92*
Turnover ratio	Coefficients	0.000	−0.00	−0.00	0.00	−0.00	−0.00	0.00	0.00	0.00	0.00	0.00	0.00
	t-Statistics	1.79***	−0.37	−0.38	0.53	−0.52	−0.23	0.38	0.64	0.34	0.22	0.15	1.98**
Age	Coefficients	−0.01	−0.02	−0.01	−0.01	−0.02	−0.01	−0.01	−0.01	−0.007	−0.008	−0.005	−0.012
	t-Statistics	−6.68*	−7.23*	−6.72*	−6.48*	−7.90*	−6.76*	−6.57*	−6.53*	−2.56*	−2.86*	−2.50*	−19.27*
Cost Elasticity	Coefficient	0.93	0.94	0.94	0.91	0.89	0.90	0.93	0.90	0.98	0.98	0.97	0.93
	t-Statistics	−73.29*	−132.09*	−269.2*	−101.5*	−44.78*	−39.68*	−21.73*	−38.55*	−124.70*	−15.41*	−15.32*	−140.88*

This table reports the regression results of the translog cost function for the years 1995–2005. The dependent variable is the COST, which represents the dollar amount of a fund's total operating expenses. The explanatory variables are: international, bond, fund concentration, fund family, premium/discount from net asset value, net asset value total return, assets, standard deviation, turnover ratio, and age of the fund. To estimate cost elasticity for each year, we estimate scale economy for individual funds and then average across observations to find the scale economy measure for the entire sample. A two tailed *t*-test tests for whether the average cost elasticity is significantly different from 1.0.

*Statistically significant at the 1% significance level, **statistically significant at the 5% significance level, and ***statistically significant at the 10% significance level.

overall sample is positive and below 1.0. A two-tailed t test shows that the differences are significantly different from 1.0 for each of the 11 years. Therefore, fund expenses increase less than proportionately with increases in fund assets and CEFs do experience of economies of scale.

The economies of scale may be coming from several sources. For CEFs, fund advisory fees are a large component of the total cost of fund management, sometimes more than 50% of the expense ratio can be in the form of fund advisory costs. Usually, funds negotiate a decreasing advisory fee contract. An examination of each of the CEF prospectus shows a vast majority of the funds have negotiated breakpoints in fund advisory costs. For instance, in 1995, out of 332 CEFs in the sample, 289 have a decreasing advisory fee contract. Similarly, in 2005, 356 funds show breakpoints in advisory fees as the size of the fund increases. With increases in the size of the fund beyond a particular point, fund advisors will receive a lower fee, which results in reduced cost of fund management for large funds.

5.2. Variable analysis

An understanding of both the sign and the significance of the variables used in this analysis will provide investors with additional information to use when selecting CEFs. Notice that the natural logarithm of assets has positive coefficient estimates that are all statistically significant. This result implies positive cost elasticity in that the level of assets directly affects fund costs. However, the relationship is not proportionate because the estimated coefficients are all less than 1.0. Therefore, a percentage change in assets will lead to a smaller percentage increase in costs.

Coefficient estimates for age of the fund are negative as expected and are all statistically significant. Therefore, it appears that the greater the age of the fund, the more efficiently it is managed. Holding the size of the CEF constant, older funds result in reduced dollar cost of fund management.

Bond CEFs show a higher fund management cost in contrast to equity CEFs. The coefficient is positive in nine of 11 years, but it is statistically significant in two years only. Panel data analysis also shows that closed-end bond funds have higher fund management costs.[11]

Fund concentration or fund focus does not play a major role in influencing CEF management costs. We do not find any evidence that focused CEFs are able to enjoy lower fund management costs.

The estimated coefficients of the variable for fund families are negative and are statistically significant. Panel data analysis also shows that the fund family variable is negatively related to fund costs and is statistically significant. Thus, larger sized (in terms of assets) fund families enjoy lower costs for individual funds of the group.

International funds have a positive coefficient and are statistically significant in explaining fund costs in eight out of 11 years. Therefore, international funds have a higher fund management costs in contrast to domestic funds.

For the net asset value total return, the estimated coefficient fluctuates between positive and negative from 1995 through 2005. Out of 11 years, we obtain one positive statistically significant estimate of this coefficient and one negative statistically significant coefficient

estimate. Not all other coefficient estimates are statistically significant. Panel data analysis shows that net asset value return is positively related to the cost of managing a CEF, but is not statistically significant. Thus, fund cost and fund returns are not related.

The estimated coefficients for the premium/discount from net asset value fluctuate between positive and negative signs throughout the sample and are statistically significant in four out of 11 years. Positive coefficient estimates were expected, but two of the 11 are negative and statistically significant. Negative coefficient estimates indicate that the lower a premium, the lower the costs. Two coefficients are positive and statistically significant.

The three-year annualized standard deviation of return has the expected positive coefficient estimates and all are statistically significant. Panel data analysis reconfirms the results that we obtain for individual years. Highly volatile funds have higher expense ratios.

The turnover ratio has coefficient estimates with positive values that are very close to zero. This result means that turnover in the fund portfolio has little or no effect on fund costs. Panel data analysis also shows that the impact of turnover ratio on fund management costs is not statistically significant.

In summary, investors would prefer CEFs that had lower fund costs because of the opportunity to experience economies of scale. The characteristics of such funds includes those CEFs that have more assets, are older, invest in equities, are members of large fund families, invest in domestic assets, and have low volatility.

5.3. Economies of scale by investment objective

To estimate economies of scale for CEFs by objective, we divide the sample into four broad categories—U.S. Equity, Corporate Bonds, Municipals, and International Equity. We run panel data fixed effects model for entire sample of CEFs for the years 1995 through 2005 for each investment objective class.[12] Table 3 shows average cost elasticities for funds grouped into fund objective categories.

The panel regression results show that each investment class objective shows economies of scale with the largest economies of scale on average for closed-end international funds (cost elasticity 0.84), followed by muni funds with a cost elasticity of 0.90.[13] Higher economies of scale for closed-end international funds may be because of the fact that they have higher fixed dollar cost of fund management to begin with, but with increase in size this cost declines substantially. Therefore, the lesson for the individual investor is that if you are looking to invest in closed-end international funds, invest in large funds, because with the cost elasticity points to significant cost savings for larger sized funds and this will translate into better returns for the individual investor.

5.4. Economies of scale by fund size

To estimate economies of scale for CEFs by asset size, we divide the sample into the five size categories as shown in Table 3: below $100 million, $100 million to below $200 million,

Table 3 Average cost elasticity by fund objective and by fund size

Part A: Economies of scale by fund objective				
	Bond funds	Muni funds	U.S. equity	International equity
Cost elasticity panel data model (1995–2005)	0.93 (−52.66*)	0.9 (−426.01*)	0.94 (−12.45*)	0.84 (−107.86*)

Part B: Economies of scale by fund size					
	Less than $100m	$100m and above and below $200m	$200m and above and below $350m	$350m and above and below $500m	$500m and above
Cost elasticity panel data model (1995–2005)	0.86 (−175.98*)	0.8 (−25.41*)	0.99 (−6.11*)	0.78 (−19.57*)	0.98 (−5.58*)

Using panel data analysis, Part A reports the average cost elasticity by closed-end fund objectives for 11 years, 1995–2005. We use the following equation for estimating the cost elasticity for each fund group: ∂ (ln COST)/∂(ln ASSETS) = $\beta_1 + \beta_2$(ln ASSETS). Part B shows the average cost elasticity by dividing the sample into five groups based on fund size. We estimate the average cost elasticity using panel data model that pools all the observations based on size. We estimate scale economy for individual funds and then average across funds to find the group elasticity. If cost elasticity is less than one it means that economies of scale exist that is, closed-end fund expenses increase less than proportionately with change in fund assets. A two-tailed *t*-test tests for whether average cost elasticity is significantly different from 1.0.

*Statistically significant at the 1% significance level, **statistically significant at 5% significance level.

$200 million to below $350 million, $350 million to below $500 million, and greater than $500 million. We use panel data approach to run a regression on the entire sample of funds for 1995 through 2005 within each size category.[14] We estimate a scale economy measure for each CEF in each subsample and then average across observations to derive the cost elasticity for each subsample for each of the three size categories. Table 3 also presents average cost elasticities for funds groups divided into the five size categories.

Panel data results in Table 3 show that all size categories show economies of scale, but the funds in the fourth size category (≥$200m and <$350m), show the largest economies of scale with a cost elasticity of 0.78. Table 3 also shows that for the smallest asset size category (<$100 million), panel data analysis confirms existence of economies of scale with cost elasticity at 0.86.[15]

For the second size category (≥$100m and <$200m), panel data model shows cost elasticity at 0.80 for this size category, which means economies of scale have gone up with an increase in size.[16] Panel data for the third size category (≥$200m and <$350m), show minimal economies of scale with a cost elasticity of 0.99.[17] The fourth size category (≥$350m and <$500m) exhibits the highest economies of scale with a cost elasticity of 0.78.[18] For the largest size category, existence of economies of scale, although small (0.98), generally is confirmed by the panel data model.[19]

In summary, the analysis of the panel data show that the largest economies of scale for CEFs occurs in the fourth fund size category of (≥$350m and <$500m). As such, smaller CEFs should strive to increase their asset bases to this range.

6. Implications for individual investors and financial planners

CEFs continue to be a popular outlet for investment by the U.S. household. According to Investment Company Institute Fact Book (2008), an estimated 2.3 million U.S. households held CEFs in 2007 and the amount of assets under management in CEFs reached $315 billion by the end of 2007, which shows an increase of 120% since the year 2000. Although the dollar amount of assets managed by CEF industry has increased several folds, empirical research on economies of scale in the CEF industry is still limited. The issue of economies of scale is important for several reasons.

For investors who use CEFs in their portfolios, it is important to understand whether this growth in fund assets provides benefits through the existence of economies of scale, because fund management costs impact returns to investors. To aid individual investor in fund selection, this study provides an insight into the determinants of cost efficiencies in the CEF industry for the period 1995 to 2005. The analysis tests for the existence of economies of scale and identifies the factors that impact fund management costs in the CEFs. Previous published studies on economies of scale are focused on OEFs and examine data for one year only. No study has looked at economies of scale in the CEF industry over an extended period of time. We study economies of scale over a period of 11 years from 1995 to 2005. Because fund management costs have a direct impact on return to investors, this study provides useful insight into the impact of various factors on fund management costs, economies of scale in the CEF industry and its ultimate impact on the return to investor. We find the cost elasticity to be less than one for the overall samples of funds for each of the 11 years, which points towards the existence of economies of scale in CEFs. Therefore, individual investors should in general invest in larger sized CEFs, because cost of fund management will be lower and it will translate into higher returns for the investor. Our results show that investors should look for funds that are part of a large fund family, because membership in a fund family has a consistent negative impact on fund costs throughout the sample. Similarly, older CEFs carry lower fund management costs.

Average cost elasticities are also found for CEFs grouped according to size and investment objective. All fund groups by investment objective exhibit economies of scale. On average, panel regression results show that cost elasticities are less than 1.0 and statistically significant for all funds that belong to different size categories. Significant differences in elasticity exist among the partitions of funds by asset size and investment objective. Therefore, investors seeking lower costs CEFs should concentrate on funds that have more assets, are older, invest in equities, are members of large fund families, and have low volatility.

Notes

1. Source: Investment Company Institute, 2006, Investment Company Fact Book and ICI Website.
2. Chance and Ferris (1991) and Malhotra and McLeod (1997).
3. See Ivković (2002); Sirri and Tufano (1998); Siggelkow (1998, 2003); Nanda, Wang,

and Zheng (2000); Barber, Odean, and Zheng (2004); and Khorana and Servaes (2004).

4. In the area of CEFs in 2004, Putnam High Income Opportunities Trust (PCV) merged into Putnam High Income Bond Fund (PCF); and Putnam Master Income Trust (PMT) merged into Putnam Premier Income Trust (PPT) to lower operating expenses.
5. Furthermore, the results may assist in the management of these funds. When establishing a new CEF, the board of directors may want to adjust the number of shares to be issued to achieve maximum economies of scale. Alternatively, the board of directors of an existing fund may want to vote for a subsequent issue of shares to achieve economies of scale.
6. As an alternative to issuing new shares to increase fund assets, some CEFs use leverage that may contribute to economies of scale.
7. Scale economies in stock selection should be interpreted with caution. Large OEFs like Fidelity Magellan may be hurt in terms of "prices" because of its size. Its purchases are so large that it either has to buy in such large amounts that it moves prices or buy "chunks" over some time period, likely leading to an overall higher purchase price. Nevertheless, there are likely some scale economies in stock selection. Moreover, we do not encounter any CEF similar in size to Magellan.
8. Unlike mutual funds, CEFs are not subject to inflows of new money to manage, which restricts the speed with which they can grow, and limits their size, and consequently, the extent of the economies of scale. Cashman (2005).
9. A translog cost function is a Taylor series expansion for estimating the dual of a Cobb-Douglas production function. In the area of models of producer behavior, the paper by Arrow, Chenery, Minhas, and Solow (1961) calls into question the inherent restriction of the Cobb-Douglas model that all elasticities of factor substitution are equal to 1. Researchers have since developed numerous flexible functions that allow substitution to be unrestricted. The transcendental logarithmic, or translog, function is the most frequently used flexible function in empirical work. The function was developed by Kmenta (1967) as a means of approximating the production function. According to Guilkey, Lovell, and Sickles (1983), a translog function is the most reliable of the several available alternatives.
10. Many studies have used translog cost functions to study economies of scale in the financial services industry. These include studies by Bers, Springer, and Thomas (1990) (real estate investment trusts); Goldberg, Hanweck, Keenan, and Young (1991) (securities industry); Drake (1992) (U.K. Building societies); Noulas, Miller, and Ray (1993) (large sized U.S. banks); Zumpano and Elder (1994) (real estate brokerage services); Clark and Speaker (1994) (banking industry); McNulty, Verbrugge, and Blackwell (1995) (thrifts); Altunbas and Molyneuz (1996) (French, German, Italian, and Spanish banking markets); Lang and Welzel (1996) (German cooperative banks).
11. The higher management costs could be because of the lower average assets of bond funds relative to equity funds.
12. Although not reported here, we also run separate regressions for each objective category using the model in Eq. (2). We estimate a scale economy measure for each

CEF in each sub-sample and then average across observations to derive the cost elasticity for each sub-sample for each of the four objective categories of the CEF sample.

13. The average cost elasticity for each investment objective is below one and statistically significant except for closed-end domestic equity funds for the year 2004. With the average cost elasticity being less than one, closed-end bond funds, closed-end equity international funds, and closed-end municipal funds also show statistically significant economies of scale for each of the 11 years.
14. We also run separate regressions for each size category using the model in Eq. (2).
15. For the smallest asset size category (<$100 million), CEFs experience economies of scale for all the years in the sample.
16. Significant economies of scale existed until the year 2003. For the years 2004 and 2005, there are no economies of scale in this size classification.
17. The minimal economies of scale for this size classification is because of a lack of economies of scale for the years 1997, 1999, 2002, and 2004.
18. There is a lack of consistent economies of scale across all the years with 2000, 2001, and 2003 showing no economies of scale.
19. The largest size category shows economies of scale for all years except for the years 2000, 2001, and 2004.

References

Altunbas, Y., & Molyneuz, P. (1996). Economies of scale and scope in European banking. *Applied Financial Economics*, *6*, 367–375.

Anderson, S. C., & Born, J. A. (1987a). The effect of market imperfections on asset pricing and risk: An empirical examination. *The Journal of the Midwest Finance Association*, *16*, 1–17.

Anderson, S. C., & Born, J. A. (1987b). Market imperfections and asset pricing. *Review of Business and Economic Research*, *23*, 14–25.

Arrow, K., Chenery, H., Minhas, B., & Solow, R. (1961). Capital-labor substitution and economic efficiency. *Review of Economics and Statistics*, *45*, 225–247.

Balestra, P. (1995). Introduction to linear models for panel data. In L. Mátyás & P. Sevestre (Eds.), *The Econometrics of Panel Data: A Handbook of the Theory with Applications*. Boston: Kluwer Academic Publishers.

Baltagi, B. (2000). *Econometrics of Panel Data*. New York: John Wiley and Sons.

Barber, B., Odean, T., & Zheng, L. (2003). Out of sight, out of mind: The effects of expenses on mutual fund flows. *Journal of Business* (Forthcoming).

Baumol, W., Goldfeld, S., Gordon, L., & Koehn, M. (1990). *The Economics of Mutual Fund Markets: Competition Versus Regulation, Rochester Studies in Economies and Policy Issues*. Boston: Kluwer Academic Publishers.

Bers, M., & Springer, T. (1997). Economies of scale for real estate investment trusts. *Journal of Real Estate Research*, *14*, 275–290.

Cashman, G. D. (2005). *Advisory Contract: Constant vs. Declining Compensation Rates*. Working Paper, Arizona State University.

Chance, D. M., & Ferris, S. P. (1991). Mutual fund distribution fees: An empirical analysis of the impact of deregulation. *Journal of Financial Services Research*, *5*, 25–42.

Ciccotello, C., Miles, J., & Walsh, L. (2006). Should investors choose funds from focused families? *Financial Services Review, 15*, 247–264.

Clark, J., & Speaker, P. (1994). Economies of scale and scope in banking: Evidence from a generalized translog cost function, *Quarterly Journal of Business and Economics, 33*, 3–25.

Collins, S., & Mack, P. (1997). The optimal amount of assets under management in the mutual fund industry. *Financial Analysts Journal, 53*, 67–73.

Connelly, T. (1997). A billion here, a billion there, and pretty soon you're talking about real money. *Journal of Financial Planning, 10*, 36–38.

Crawford, P. J., & Harper, C. P. (1985). An analysis of the discounts on closed-end mutual funds. *The Financial Review, 20*, 30.

Dermine, J., & Roller, L. (1992). Economies of scope and scale in French mutual funds. *Journal of Financial Intermediation, 2*, 83–93.

Drake, L. (1992). Economies of scale and scope in UK building societies: An application of the translog multiproduct cost. *Applied Financial Economics, 2*, 211–219.

Ferris, S. P., & Chance, D. M. (1987). The effects of 12b-1 plans on mutual fund expense ratios: A note. *The Journal of Finance, 62*, 1077–1082.

Fortin, R., & Michelson, S. (1998). Mutual fund trading costs. *Journal of Investing, 7*, 66–70.

Gaspar, J., Massa, M., & Matos, P. Favoritism in mutual fund families? Evidence on strategic cross-fund subsidization. *The Journal of Finance* (Forthcoming).

Goldberg, L., Hanweck, G., Keenan, M., & Young, A. (1991). Economies of scale and scope in the securities industry. *Journal of Banking and Finance, 15*, 91–107.

Guilkey, D. K., Lovell, C., & Sickles, R. (1983). A comparison of the performance of three flexible functional forms. *International Economic Review, 24*, 591–617.

Investment Company Institute. (2008). *Fact Book on Closed-End Funds*. Available at http://www.icifactbook.org/fb_sec4.html.

Ivković, Z. (2002). Spillover in mutual fund families: Is blood thicker than water? *Essays in Financial Economics,* Yale University Doctoral Dissertation.

Jayaraman, N., Khorana, A., & Nelling, E. (2002). An analysis of the determinants and shareholder wealth effects of mutual fund mergers. *Journal of Finance, 57*, 1521–1551.

Khorana, A., & Servaes, H. (1999). The determinants of mutual fund starts. *The Review of Financial Studies, 12*, 1043–1074.

Khorana, A., & Servaes, H. (2004). *Conflicts of Interest and Competition in the Mutual Fund Industry.* Working Paper, Georgia Institute of Technology.

Kmenta, J. (1967). On estimation of the CES production function. *International Economic Review, 8*, 180–189.

Lang, G., & Welzel, P. (1996). Efficiency and technical progress in banking: Empirical results for a panel of German cooperative banks. *Journal of Banking and Finance, 20*, 1003–1023.

Latzko, D. (1999). Economies of scale in mutual fund administration. *Journal of Financial Research, 22*, 331–339.

Malhotra, D. K., Martin, R., & Russel, P. (2007). Determinants of economies of scale in the mutual fund industry. *Review of Financial Economics* (Forthcoming).

Malhotra, D. K., & McLeod, R. W. (1997). An empirical analysis of mutual funds expenses. *Journal of Financial Research, 20*, 175–190.

Malhotra, D. K., & McLeod, R. W. (2000). Closed-end fund expenses and investment selection. *The Financial Review, 35*, 85–104.

McLeod, R. W., & Malhotra, D. K. (1994). A re-examination of the effect of 12b–1 plans on mutual fund expense ratios. *Journal of Financial Research, 17*, 237–244.

McNulty, J., Verbrugge, J., & Blackwell, D. (1995). Thrift scale economies: An alternative approach. *Quarterly Journal of Business and Economics, 34*, 47–59.

Nanda, V., Wang, A., & Zheng, L. (2000). *Family Values and Star Phenomenon.* Working Paper, University of Michigan.

Noulas, A., Miller, S., & Ray, S. (1993). Regularity conditions and scope estimates: The case of large-sized U. S. banks. *Journal of Financial Services Research*, 7, 235–248.

Noulas, A., Ray, S., & Miller, S. (1990). Returns to scale and input substitution for large U. S. banks. *Journal of Money, Credit, and Banking*, 22, 94–108.

Siggelkow, N. (1998). *Benefits of Focus, Evolution of Fit, and Agency Issues in Mutual Fund Industry.* Doctoral Thesis, Harvard University.

Siggelkow, N. (2003). Why focus? A study of intra-industry focus effects. *Journal of Industrial Economics*, 51, 121–150.

Sirri, E., & Tufano, P. (1993). Competition and change in the mutual funds industry. In S L. Hayes, III (Ed.), *Financial Services*. Boston: Harvard Business School Press.

Trzcinka, C., & Zweig, R. (1990). *An Economic Analysis of the Cost and Benefits of SEC rule 12b-1, Monograph Series in Finance and Economics, Leonard Stern School of Business.* New York: New York University.

Zumpano, L., & Elder, H. (1994). Economies of scope and density in the market for real estate brokerage services. *Journal of American Real Estate and Urban Economics Association*, 22, 497–513.