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Mutual fund trading costs

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027-99

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This Version: November 2, 1999
First Version: March 15, 1998

An empirical analysis of mutual fund trading costs

Abstract

We estimate trading costs for a sample of equity mutual funds and find that these costs average 0.78% of fund assets per year. There is substantial cross sectional variation in these costs, with an inter-quartile range of 0.59%. Trading costs are negatively related to fund returns. In fact, the explanatory power of trading costs is as strong as that of the expense ratio. We find that the cross-sectional variation in trading costs is greater than that implied by turnover, and trading costs have more explanatory power for fund returns. Nonetheless, we find that turnover is an important factor in assessing mutual fund trading costs.

1. **Introduction**

In this paper we estimate the costs of mutual funds' equity trading and the association between those costs and fund returns. The trading costs that we focus on are spread costs and brokerage commissions. Spread costs are tallied using a fund-by-fund, quarter-by-quarter examination of stocks traded, accompanied by a transaction-based estimate of the spread-related cost of each trade. Brokerage commissions are disclosed in the Securities and Exchange Commission's (SEC) N-SAR filing. While there has been ample reference to trading costs and their potential effect on return performance in the literature, dating back at least to Jensen (1968), a direct analysis of fund trading costs has not been conducted. Rather, most research has made a necessarily loose connection between fund turnover and trading costs.

An analysis of fund trading costs contributes to inferences regarding the value of active fund management. Grossman and Stiglitz (1980) suggest that informed traders will trade only to the extent that the expected value of the information is greater than the costs incurred to gather the information and implement the trades. Expense ratios can be interpreted as information gathering costs and our results confirm the negative relation between expense ratios and fund returns of other studies (e.g. Jensen (1968), Elton, et al, (1993), Malkiel (1995), and Carhart (1997)). Trading costs can be interpreted as the costs of implementing a trading strategy. Using direct estimates of fund trading costs, we extend many of the conclusions drawn in indirect analyses of fund trading costs and return performance (see e.g. Grinblatt and Titman (1989), Elton et. al. (1993), Carhart (1997) and Edelen (1999)). In addition, our analysis adds to the growing literature on the costs of institutional trading in a novel way. Papers such as Keim and Madhavan (1993, 1995), Chan and Lakonishok (1995), and Jones and

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Lipson (1999) examine trade execution costs for specific institutional trades. Here we aggregate trading costs and document the accumulated effect on return performance.

We find that trading costs incurred by mutual funds are large. As a fraction of assets under management, we estimate that brokerage commissions average .30% and spread costs average .47% annually. More importantly, there is substantial variation in these costs across funds. For example, the difference in trading costs between funds in the 25th and 75th percentile is 59 basis points, which is greater than the 48 basis point difference in expense ratios across the same range. We decompose funds' trading costs into three components turnover, the average transaction cost of stocks in the fund, and fund managers' sensitivity to trading costs. Turnover, a common proxy for trading costs captures roughly 55% of the variation in trading costs, the average transaction cost of stocks in the fund captures 30% and fund managers' cost sensitivity of trading captures 5%.

We examine the relation between expense ratios, trading costs and fund returns. We find that fund returns (measured as raw returns, CAPM-adjusted returns, or Carhart four factor-adjusted returns) are significantly negatively related to expense ratios and trading costs. Furthermore, while turnover is a determinant of trading costs, it fails to capture substantial cross-sectional variation in fund returns attributable to trading costs. Consistent with Elton et al (1993) and Carhart (1997) we find a negative relation between turnover and fund returns. However, the relation between turnover and fund returns is weaker than that between expense ratios and fund returns. By contrast, regressions using our direct estimates of trading costs suggest that trading costs are more important than expense ratios to fund returns.

In addition to the potential effect on fund returns, fund managers' observed trading behaviors are interesting from an empirical point of view. We find somewhat surprisingly that

there are a substantial number of funds that hold stocks with the highest spread costs and these same funds have the highest turnover. We also find that there are a substantial number of funds holding the lowest spread cost stocks that have the lowest turnover. Amihud and Mendeleson (1986) argue that trading in high-cost stocks should be less than low-cost stocks. The patterns that we find are inconsistent with a general adherence to that rule.

Given the widespread use of fund investment objectives to classify fund types, we provide a brief analysis of the relation between investment objective and trading costs. We find that on average investment objectives are related to fund costs in the manner one would expect, that is aggressive growth funds have higher average costs than growth and income funds. However, we also find that variation within investment objectives is much larger than variation across investment objectives. Thus, the impact of trading costs goes beyond the standard classification of funds' investment objectives.

The general organization of the paper is to provide a description of our sample data and how we estimate trading costs. We then provide simple descriptions of trading costs and how they are distributed by fund size and how the trading costs are related to returns in panel data and then in Fama MacBeth (1973) style regressions. We decompose these trading costs into their components and assess the component's association with returns. Finally we provide a brief analysis of the relation between investment objective and trading costs to address the question: to what extent does a fund's investment objective inform investors about the level of trading costs?

2. Data

2.1. Sample selection and data sources

Following Edelen (1999), 165 funds are randomly sampled from the 1987 summer volume of Morningstar's *Sourcebook*, Twenty-nine funds are dropped because portfolio holdings data

are unavailable. Four funds are dropped because the funds held less than 50% of their assets in equity for the entire sample period (1984-1991). We require a minimum of 50% equity due to the fact that our data for estimating trading costs is limited to equity securities. We are left with a sample of 132 funds. The sample represents a variety of investment objectives. Using CRSP mutual fund investment objective classifications, our sample is 25% aggressive growth funds, 39% growth funds, 28% growth and income funds, and 8%, income funds.

Table 1 compares our sample funds to the relevant universe of mutual funds in the CRSP database during 1987. Specifically, we restrict funds in the CRSP database to those with investment objectives that include common stock and hold at least 50% of their assets in equity. The requirement that at least 50% of a fund's assets be held in equity restricts our sample to 92 funds during 1987 while the comparison sample from the CRSP database has 341 funds. From Table 1, the sample is representative of the funds in the CRSP mutual fund database in terms of style classification, age, total assets, expense ratios, turnover, average return, and survival.

We use holdings data to infer funds' trading decisions. The equity holdings for each fund are hand-collected from volumes of *Spectrum II*, a publication of CDA Investment Technologies, Inc. *Spectrum II* provides quarterly snapshots of funds' equity holdings and have been used extensively by Grinblatt and Titman (1989) and Wermers (1998).[1] We collect the holdings data for the time period January 1984 through December 1991. We have an average of 18 time-series observations of holdings data per fund. Quarterly holdings data are available for 90% of the sample while 10% of the holdings are observed semi-annually. Figure 1 shows the distribution of holdings data for our sample funds through time and by investment objective. Using these

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[1] Wermers (1999) provides an excellent description of the data-collection process used by CDA. Because we have collected the data from hard-copy volumes, our data may not reflect updates that CDA has made to correct errors, and we may have introduced errors by way of data entry.

holdings data, we infer funds' trading activity from changes in the position of each stock held by each fund after adjusting for stock splits and CDA reporting adjustments.[2]

Because data for estimating trading costs of foreign stocks are not available from our data sources, purchases and sales of foreign stocks are dropped. These omissions are likely to be minor since foreign stocks account for less than .4% of the sample funds' holdings. In addition, the snapshot nature of the portfolio-holding data limits our proxy for the fund's trading activity. For example, if a stock was bought and sold between disclosure dates we would not capture the transaction. We also do not capture trading in bonds and other fixed income securities with the CDA data. For 1,700 of our 2,315 fund quarters of holdings data, we have data from the SEC's N-SAR filings which report funds total purchases and sales activity on a semi-annual basis. We use these data to gauge how well the CDA portfolio-changes capture trading activity. On average our proxy captures 87% of the trading reported in the N-SAR report.

We obtain data on fund returns, turnover, and expense ratios from the Center for Research in Security Prices (CRSP) mutual fund database and data on fund brokerage fees, client flows, and total purchases and sales from the SEC's N-SAR report. We obtain data on stock returns, prices, and shares outstanding from the CRSP daily returns files and data on book value of equity from Compustat's industrial research and tertiary file. Finally, we obtain data on bid-ask quotes, transaction prices, and transaction volumes from the Institute for the Study of Securities Markets (ISSM) transaction files.

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[2] CDA reports are issued at quarter-end in March, June, September, and December. For funds that report holdings for other quarter-end months, say January, April, July, October, CDA reports January's holdings in March. However, CDA updates the January holdings for any splits or other stock distributions that occur in February or March.

2.2. Estimating trading costs

In our analysis of mutual fund trading costs we consider brokerage commissions and spread related costs, which we label direct costs of trading. We also consider tax costs due to the realization of capital gains, which we label indirect costs since these costs impact investors' returns but not the mutual funds' returns. We discuss these costs in turn.

2.2.1. Brokerage commissions

Brokerage commissions are sporadically available for 99 of the 132 funds from N-SAR reports filed with the SEC. Specifically, we have brokerage commission data for 42% of all fund-quarter observations. To estimate brokerage commissions for the missing fund-quarter observations, we assign funds to quintiles on the basis of turnover and expense ratios.[3] Our brokerage fee estimate for each missing observation is the median brokerage fee for its corresponding turnover-expense ratio quintile. As a gauge of the in-sample reliability of these estimates, the R-square for the regression of brokerage commissions on turnover rank and expense ratio rank is .42.

2.2.2. Spread costs

We estimate a fund's spread cost when trading stock i in quarter t using the volume-weighted average effective spread for all trades recorded in the ISSM database for stock i in quarter t:

$$\text{effective spread}_{it} = \sum_{k=1}^{K} \left(\left| \frac{P_{ik} - M_{ik-}}{M_{ik-}} \right| \cdot \frac{Shrs_{ik}}{\sum_{k=1}^{K} Shrs_{ik}} \right), \tag{1}$$

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[3] In estimating brokerage commissions we considered several potential factors in addition to turnover and expense ratios including: fund size, number of trades, and average trade size.

where k ranges over the set of all transactions in the ISSM database for stock i in quarter t; P_{ik} is the transaction price; M_{ik-} is the midpoint of the bid and ask quotes immediately preceding transaction k; and $Shrs_{ik}$ is the number of shares traded. Given that mutual fund trades are relatively large, the volume weighted effective spread of equation (1) is more relevant for estimating spread costs for mutual fund trades than an equally weighted effective spread because it places greater weight on the cost of larger trades. We estimate annual spread costs for each fund as the product of the dollar value of each trade multiplied by the effective spread estimate in equation (1) summed over all trades for the fund each quarter and divided by the value of the fund's assets/equity.[4]

The ISSM transaction data cover stocks that are listed on either the AMEX or the NYSE. By value 20% of our sample fund holdings are listed on the NASDAQ. We do not have transaction data to estimate the effective spreads of NASDAQ stocks directly. To estimate effective spreads for these stocks, each quarter we assign all stocks on the NYSE, AMEX and NASDAQ to deciles based on share price. Within each share-price decile we assign stocks to deciles according to market value of equity. We then estimate the effective spreads of NASDAQ stocks using the median effective spread for the corresponding price-size cell in the ten-by-ten grid of NYSE/AMEX effective spreads. As a gauge of the in-sample reliability of these estimates, the average R-square for the cross-sectional regressions of effective spreads on the corresponding price-rank and size-rank for NYSE/AMEX stocks is .71.

A potential limitation of our spread cost estimates is that, for a given stock in a given quarter, we calculate spread costs using the same effective spread for all fund trades regardless of trade size. Trading costs are likely to depend on the size of the total trade package (i.e., the

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[4] We scale by equity when necessary to reduce heterogeneity in spread cost estimates due to our inability to estimate spread costs for funds' non equity holdings.

quarterly position change) as well as how the trade package is broken up into individual trades. Using data on actual trade packages of institutional investors Chan and Lakonishok (1995) find that 78% of institution's trade packages are executed over two or more days. Since we do not know how fund position changes are executed during the quarter we apply the same effective spread to all fund trades in a given stock during a given quarter. While this may introduce noise into our estimates of fund trading costs, we provide evidence which suggests that it does not introduce significant biases.

2.2.3. Estimating capital gains

To estimate capital gains associated with fund managers' trading decisions we first estimate the tax-basis for each stock held by each fund. We assume that: the tax-basis for the fund's initial holdings in our database is the price of each stock one-year prior to the first observation of holdings data;[5] the tax-basis for all subsequent holdings is equal to the stock's price at the midpoint of the quarter in which it was purchased; and funds use average costing to determine the tax-basis of shares sold as opposed to specific identification. Specific identification gives fund managers greater flexibility in managing the tax-timing options in the fund's portfolio. Nonetheless, Huddart and Narayanan (1997) report that most funds use average costing.

As in Huddart and Narayanan (1997), the basic variable in the analysis of capital gains is the estimated capital gain or loss of each position as a fraction of its current value:

$$gain_{jit} = \frac{P_{it} - basis_{jit}}{P_{it}}, \tag{2}$$

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[5] This assumption is motivated by the fact that the average holding period of each stock of our sample funds is approximately one year. If stock price data are not available one year prior we roll forward in 3 month increments until stock price data are available.

where P_{it} is the price of stock i as of the midpoint of quarter t, and $basis_{jit}$ is the basis of stock i as of the midpoint of quarter t for fund j. $gain_{jit}$ is bounded above by one but can be an arbitrarily large negative number. There are very few extreme negative observations and truncating these observations has no effect on the analysis. An unrealized gain is the capital gain that would arise if a position were sold during the quarter while a realized gain is the gain that arises from an actual sale.

2.3. Characteristics of the sample funds and their holdings

Table 2, Panel A, presents characteristics of the sample of 132 mutual funds. The average fund has \$374 million in total assets, with 81% invested in equity. The median fund is much smaller with \$153 million in assets, while the median proportion invested in equity is comparable to the mean at 85%. The average fund earned an annualized return of 13.2% and the median return is 13.9% during the sample period. Average (median) equity turnover is 76% (70%) of assets managed, where turnover is defined as fund sales scaled by total fund assets. Funds at the 25th percentile have less than half the turnover of funds at the 75th percentile, indicating that turnover varies substantially across funds. Finally, the average fund has a ratio of annual client inflow to assets of 39% and annual client outflows to assets of 40%.

Table 2, Panel B presents characteristics of the stocks held by the sample funds. The average fund holds 82 stocks. To compare the stocks held by these funds to the universe of stocks traded on the NYSE, AMEX, or NASDAQ, we form deciles each quarter based on various stock characteristics with equal numbers of stocks in each decile for the universe of stocks. We report equally weighted means of the ranks and characteristics in Panel B.

Relative to the median stock (with a rank of 5.5), the stocks held by the funds in our sample have much larger capitalization (decile 9.2), high dividend yields (decile 7.0), high share prices

(decile 8.7), low effective spreads (decile 2.1), low return volatility (decile 3.6), average beta risk (decile 5.4), slightly below average book to market ratios (decile 5.2), and high prior-year returns (decile 6.8). These results are consistent with those of Del Guercio (1996), Falkenstein (1996), Gompers and Metrick (1998), and Daniel, Grinblatt, Titman and Wermers (1997) who report that institutional investors have preferences for large, liquid stocks with high past returns, and median to slightly below median book-to-market ratios.

3. Fund Costs

In this section we report our estimates of fund costs and examine the relation between fund costs and fund size.

3.1. Cost estimates

Table 3 provides summary statistics of fund expense ratios, brokerage commissions, spread costs, and capital gains. Expense ratios include the fund management fee, administrative costs, and other operating expenses such as audit fees, directors' fees and taxes and 12b-1 distribution fees. From Table 3, the average fund expense ratio is 1.07% of assets and the median expense ratio is 1.03%. Our sample average expense ratios are comparable to the average expense ratio of 1.08% in Carhart (1997) and 1.13% reported in Gruber (1996). There is considerable variation in expense ratios across funds as seen by the 48 basis point difference between the expense ratios of the 25th and 75th percentiles.

Expense ratios do not reflect trading costs, which include brokerage commissions and spread costs, nor do they include the costs associated with the realization of capital gains. From Table 3, average annual brokerage commissions are 0.30% of fund assets. As with expense ratios, there is considerable variation across funds in brokerage-commission costs as seen by the 30 basis point difference between the 25th and 75th percentiles. The average fund spends 0.47%

of fund assets each year on spread costs.[6] This estimate likely understates the actual cost for two reasons. First, our estimate is based on average effective spreads and may not fully reflect the price impact of large trades. Second, we fail to capture 13% of trading activity using quarterly snapshots of holdings, implying that, *ceteris paribus,* an unbiased estimate would be scaled up by 0.87^{-1} or 1.15. Again, we find considerable variation across funds in spread costs, as seen by the 37 basis point difference between the 25th and 75th percentiles. Summing brokerage commissions and spread costs, on average funds spend .78% of their assets on trading each year. More importantly, the inter-quartile range for these trading costs is 59 basis points which is greater than the 48 basis point inter-quartile range for expense ratios.

For comparison purposes we estimate funds' trading costs using the methodology proposed by Grinblatt and Titman (1989). Grinblatt and Titman estimate funds' trading costs by comparing actual fund returns to hypothetical fund returns. Hypothetical fund returns are calculated using CDA portfolio holdings data and CRSP stock returns data. They reflect the returns to the portfolio of stocks held by funds, but, unlike actual fund returns, hypothetical fund returns do not include expense ratios, brokerage commissions, or spread costs. Thus, the difference between the two returns provides an estimate of total fund costs. An estimate of trading costs is obtained by subtracting the expense ratio from the difference in returns.

This indirect approach to estimating trading costs is noisy relative to our direct estimates. The noise is due in large part to the assumptions that must be made concerning the price at which stocks are purchased and sold during the quarter in the hypothetical portfolio. This noise is evident in the indirect estimates we compute for our sample funds. Following Grinblatt and Titman, we find that the implicit trading cost for the 25th percentile is –1.09% of fund assets. In

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[6] This number is higher than reported in prior versions of this paper (.34%) because our prior results used equally weighted averages to estimate the effective spread. Using volume weighted effective spreads increases the spread estimates because larger

fact, the hypothetical portfolio has *worse* returns than the actual fund in more than 35% of the fund-quarter observations. Despite the evident noise, the Grinblatt and Titman measure should provide an unbiased estimate of fund trading costs. We find that the average estimate using their procedure comes remarkably close to our direct estimates. If we limit our analysis to funds with at least 90% equity in their portfolio, a sample of 88 funds,[7] the average direct estimate of annual trading cost is 0.92% of fund assets while the average implicit estimate is 1.03% of fund assets. These two estimates are statistically indistinguishable. This suggests that our estimates of fund spread costs using volume-weighted average effective spreads of eq. (1) are not materially biased.

Finally, we examine capital gains realizations, which generate an indirect cost of trading, which influence investors' after-tax returns. From Table 3, the average fund realizes net capital gains of 5.32% of total assets annually. The net capital gain is measured in excess of tax-loss carry forwards and therefore estimates the taxable capital gains passed through to investors.

This gain realization accelerates the due date for capital-gains taxes, but it does not represent the incremental tax cost of the fund managers' trading activity. When investors redeem fund shares, capital gains are recognized irrespective of the fund managers' trading activity. Given an annual redemption rate of 40% of fund assets from Table 2, the typical capital-gains deferral is 2.5 years. Therefore, turnover of equity holdings in the fund portfolio accelerates capital-gains realization by about 2.5 years. For investors facing a 28% capital-gains tax rate, this acceleration of gain recognition by the fund manager increases the present value of tax payments by roughly $0.28\left(1 - e^{-0.11*2.5}\right) \cong 6.7\%$ per dollar of capital gain realized, assuming an 11% discount rate. Thus, the estimated tax cost imposed on investors from the 5.32% annual gain

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trades tend to have larger effective spreads.

realization is 0.36% per year. This assumes all accounts are fully taxable. Of course, for tax-deferred accounts, the incremental cost of gain recognition by the fund manager's turnover is zero. During the sample period (1984-1991) less than 20% of mutual fund assets were held in tax-deferred accounts (*Investment Company Institute 1998 Fact Book*).

Summing brokerage commissions, spread costs, and tax costs, funds' trading activities cost an average of 1.14% of fund assets annually. The magnitude of these invisible costs, as Bogle(1994) refers to them, is comparable to the magnitude of the more easily observed expense ratio. More importantly, the cross-sectional variation in these invisible costs is twice that of expense ratios. In particular, the inter-quartile range of invisible costs is 96 basis points while the inter-quartile range of expense ratios is 48 basis points. Thus, if one seeks to discriminate between funds on the basis of fund costs, trading costs and tax costs add economically relevant information relative to a study of expense ratios alone.

3.2 Fund costs and fund size

Expense ratios generally decline with fund assets, indicating a large fixed-cost component. The previous section shows that expense ratios are only half of the story when it comes to total fund costs. We define total fund costs to include brokerage commissions, spread costs and expense ratios. This section examines the extent to which large funds are more cost-efficient than smaller funds when all costs are considered.

Fig. 2 relates total fund costs to fund size. To create Fig. 2 Panel A, funds are placed into size quartiles using each fund's average assets under management in each year of the sample period. The average brokerage commissions, spread costs, and expense ratios are plotted in the bar graphs for each quartile. The bar graphs show that smaller funds have higher expense ratios

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[7] For funds with large fixed income/cash holdings returns calculated from equity holdings will tend to overstate the return on the

than larger funds. The relation between trading costs and size is much less clear. Across size quartiles 1-3 spread costs and brokerage commissions are relatively constant proportions of assets managed, although the largest funds appear to have lower spread costs and brokerage commissions. To create Panel b in Fig. 2 we use the annual averages for each fund in each year and calculate the cross-sectional correlation coefficient between assets under management and each of the cost variables in each year. We average the correlation coefficients over time in the average row. In Panel b we see a relatively large fixed component to expense ratios, where trading costs appear to be less sensitive to fund size. The correlation between expense ratios and fund size is -0.56, where the correlation between spread costs and fund size is -0.32 and the correlation between brokerage commissions and fund size is -.30. Recall from Table 3, that the correlation between expense ratios and trading costs is 0.51. We interpret the evidence in Fig. 2 to imply that expense ratios are more like fixed costs, while trading costs are more like variable costs and do not benefit to the same extent from scale economies.

4. Fund costs and fund returns

Grossman and Stiglitz (1980) theorize that in a competitive market, traders with superior information earn abnormal returns that just offset their opportunity and implementation costs. In a delegated portfolio-management context, this implies that the portfolio return should on average offset the fees and trading costs imposed by the investment manager. In this section, we examine the association between fund returns, expense ratios, and trading costs, to see how these various costs impact the fund's bottom line. It is well documented that expense ratios are negatively associated with fund returns (see e.g. Jensen (1968), Elton et. al. (1993), Malkiel (1995), Carhart (1997)). However, a direct analysis of the relation between fund trading costs

fund's portfolio, and thus, overstate the estimate of total fund expenditures.

and fund returns has not been undertaken. Rather there has been a necessarily loose connection made between fund turnover and trading costs. (See for example Bogle (1994) p. 202-205, Carhart (1997), Metrick and Gompers (1998).) While fund turnover is likely to be related to trading costs, it is also likely that fund holdings and trade discretion play important roles in determining trading costs. Thus, it is of interest to examine the relation between fund returns, fund expense ratios, and our direct measures of fund trading cost.

4.1 Panel analysis

Table 4 presents a simple yet powerful demonstration of the association between fund costs and fund returns. There are four panels in Table 4. Each panel represents a rank ordering of funds on the basis of a different measure, or proxy, for fund costs. For example, in Panel A funds are assigned to quintiles each quarter according to total fund costs. For each quintile, we report the average total fund cost and its separate components: expense ratios, brokerage costs, and spread costs. For each quintile we also report the average fund return using three measures of returns: raw returns, CAPM-adjusted returns, and Carhart-adjusted returns. Raw returns are fund returns net of expenses, fees (excluding load fees), and trading costs. CAPM-adjusted returns are raw returns minus expected returns as specified by the CAPM. Carhart-adjusted returns are raw returns minus expected returns as specified by the Carhart four-factor model. We estimate the expected returns of these models using the same procedure as Carhart (1997) for both the CAPM-adjusted returns and for the Carhart-adjusted returns.[8] Specifically, the Carhart-adjusted return for fund *j* in in month *t is*,

$$Carhart\ adjusted\ return_{jt} \equiv R_{jt} - R_{Ft} - \widehat{b}_{jt-1}RMRF_t - \widehat{s}_{jt-1}SMB_t - \widehat{h}_{jt-1}HML_t - \widehat{p}_{jt-1}PR1YR_t, \quad (3)$$

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[8] See page 66-67 of Carhart (1997) for this description.

where R_{jt} is the return on fund j in month t, R_{Ft} is the three-month t-bill in month t, $RMRF_t$, SMB_t, HML_t, are Fama and French's (1993) excess return on the market and factor mimicking portfolios for size and book-to-market, and $PR1YR_t$ is the factor-mimicking portfolio Carhart's (1997) creates to capture one-year return momentum. We estimate the coefficients on the factor mimicking portfolios using up to three years of monthly data up to month t-1. The CAPM-adjusted returns are calculated using the same procedure above but exclude the terms involving *SMB, HML* and *PR1YR*.

Panel A of Table 4, reports average fund costs and average fund returns for funds assigned to quintiles according to total fund costs. The variation in fund costs in Panel A is greater than that observed in Table 3. This is because Table 3 reports the distribution of the time-series average of each fund's cost calculated over the entire sample period whereas Table 4 reports the average fund cost for funds assigned to quintiles each quarter. From Panel A, the inter-quintile range in total fund costs is substantial -- 222 basis points. However, the striking result is the remarkably close mapping of total fund costs to adjusted fund returns. For example, in quintile 1 average total costs are 0.90% and the annual Carhart-adjusted return is - 0.77%. In quintile 5 average total costs are 3.12% and the annual Carhart-adjusted return is – 4.38%. It appears that total fund costs bear a strong association with fund return performance. The results from a rudimentary test of the association between total fund costs and fund return performance is presented at the bottom of Table 4. For the entire sample we cannot reject the hypothesis that the Carhart-adjusted returns plus the total fund costs are zero. Thus, the activities generating fund costs have no beneficial effect on fund returns. In fact, a plausible inference from these results is that every dollar spent on trading costs results in a dollar less in returns. This is consistent with Elton et. al. (1993) who find that expense ratios are negatively

related to fund's return performance and that turnover is weakly associated with lower returns. We will return to this issue in the next section with regression results.

The remaining panels in Table 4 indicate the degree to which the association between fund returns and total fund costs is captured using alternative measures, or proxies, for fund costs.

From Panel B, sorting on expense ratios provides a fairly good separation in both total fund costs and returns. This is not surprising given the correlation between the two (Table 3) and, results found elsewhere in the literature. However, the range of return discrimination using the expense ratio is in all cases tighter than the discrimination provided by total fund costs. For example, tests comparing the returns in quintile 1 to returns in quintile 5 sorted by total fund costs, trading costs and expense ratios are significantly different for all but the raw return measures in almost every case. Sorting on turnover appears to provide some discrimination on returns, confirming results found elsewhere (e.g. Elton et. al. (1993), and Carhart (1997)). However, the return sort is much less dramatic with turnover than that provided by total costs. In the turnover-sorted panel none of the paired return comparisons between quintiles 1 and 5 are significantly different.

It is interesting that much of the variation in returns when sorting on the expense ratio is associated with higher trading costs. Trading costs in the high expense-ratio quintile are substantially larger than in the low expense-ratio quintile, and trading costs increase monotonically across expense-ratio quintiles. Thus, the evidence on the relation between expenses and returns found elsewhere in the literature is likely to be related to a more complicated relation involving trading costs.

Finally, sorting by trading costs, like the expense ratio, does a good job of sorting returns. In particular, the trading costs sort is nearly monotonic in all the return measures and the typical range of return discrimination is very similar to the range when sorting on total costs. Of course, the correlation between trading costs and expenses seen in the expense panel is apparent here as well. This raises a natural question concerning the extent to which these different panels are in fact identifying separate associations with returns. There is clearly some overlap between expenses and trading costs. We address this issue in the next section with a regression procedure.

4.2 Regression analysis

Our regression analysis uses the cross-sectional time-series procedure developed in Fama-Macbeth (1973). Table 5 reports time-series averages of coefficient estimates from cross-sectional regressions of monthly fund return measures on expense ratios and spread costs. We do not include brokerage costs in the regressions.[9] Not surprisingly the results confirm the negative association between fund returns and expense ratios, and spread costs seen in section 4.1. The most important result in this table is the fact that each of the two costs retains statistical significance controlling for the other. This indicates that both costs exert an independent influence on returns, despite their positive correlation.

The magnitudes of the coefficient estimates are interesting since they provide evidence to address the question: do larger total fund costs lead to higher returns because they imply a larger investment in security research and implementation of trading strategies? A coefficient of –1 on the expense ratio or spread cost variable would indicate a one-to-one inverse relation

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[9] Recall that the sparseness of the actual brokerage commission data forced us to estimate brokerage commissions for much of the sample and these estimates are derived from turnover and expense ratios and therefore potentially introduce collinearity that is mechanically related to variables of interest. Including the brokerage commission data in the regressions reduces the statistical significance of the expense ratio, but the other coefficients remain similar is size and significance.

between trading costs and returns, suggesting that every dollar spent is not recovered in higher adjusted returns. The point estimates of the coefficients on spread costs are for the most part more than two standard errors below –1 suggesting that funds experience worse than 1 for 1 losses in spread costs. However, this conclusion must be interpreted cautiously for two reasons. First, the spread costs variable is scaled by equity value in these regressions, not asset value, and as a result the coefficient estimate will be understated. Second the high correlation between spread costs and brokerage fees seen in Table 3 helps to explain the larger coefficient on spread costs since brokerage fees are not included in the regression spread costs are likely to pick up those costs.

In the case of the expense ratio we cannot reject the hypothesis that the coefficient on the expense ratio is equal to –1 in any of the specifications. These results are similar to Malkiel (1995) where he finds a coefficient on expense ratios of -1.92 which is not statistically different from -1.

5. The determinants of fund trading costs

Table 4 shows that turnover captures only a portion of the variation in fund trading costs and that it does a relatively poor job of explaining fund returns. Turnover is surely an important determinant of trading costs, but it is just one component. This section analyzes the determinants of trading costs more completely.

5.1 A decomposition of trading costs

Trading costs for fund j in period t may be expressed as

$$\text{trading costs}_{jt} = \sum_{i=1}^{I} \left(Brok_{jit} + Spd_{jit} \right) TradeSize_{jit} \qquad (3)$$

where i ranges over all stocks in fund j's investment opportunity set (I in total); $Brok_{jit}$ and Spd_{jit} are the percentage brokerage commission and effective spread, respectively; and $TradeSize_{jit}$ is the trade size as a percentage of total assets. Because data on brokerage commissions at the individual-trade level are unavailable and are roughly constant across trades we consider only the spread component of trading costs in what follows.

It is convenient to rewrite Eq. (3), excluding brokerage commissions, as

$$\text{spread costs}_{jt} = \overline{Spd}_{jt} \sum_{i=1}^{I} TradeSize_{jit} + \sum_{i=1}^{I} \left(Spd_{jit} - \overline{Spd}_{jt} \right) TradeSize_{jit} \quad (4)$$

where $\overline{Spd}_{jt}$ denotes the value-weighted average spread of the stocks in fund j in period t. Denote the turnover (total trading volume scaled by total assets) of fund j in period t as $T_{jt} \equiv \sum_{i=1}^{I} TradeSize_{jit}$ and the weight of stock i in fund j in period t as w_{jit}. The first term in Eq. (4) can be written:

$$\sum_{i=1}^{I} \overline{Spd}_{jt} TradeSize_{jit} = \sum_{i=1}^{I} Spd_{jit} \left(w_{jit} T_{jt} \right). \quad (5)$$

Therefore, the fund's spread costs can be written:

$$\text{spread costs}_{jt} = \overline{Spd}_{jt} T_{jt} + \sum_{i=1}^{I} \left(TradeSize_{jit} - w_{jit} T_{jt} \right) Spd_{jit}. \quad (6)$$

The first term in Eq. (6) is the average spread of the fund's portfolio times fund turnover. The second term is an adjustment to account for what we call the spread sensitivity of the fund's trading. If a fund's trading were proportional to its holdings but (otherwise) indifferent to the spread, the expected volume of trade in stock i would be $w_{jit}T_{jt}$. The difference between a fund's actual trading and this naïve benchmark, ($Tradesize_{jit}$ -$w_{jit}T_{jt}$), indicates the degree to which a fund's trading is tilted toward stocks with lower or higher spreads relative to its portfolio. Thus,

Eq. (6) decomposes a fund's total spread costs into three components: turnover, the average spread of the portfolio, and the spread sensitivity of trading.

This analysis points out two conditions that must be met for turnover to fully capture variation in funds' trading costs. First, the average spread of funds' portfolio holdings must be constant across funds and over time. Second, after normalizing against holdings, the volume of trading in a stock must be unrelated to the stock's spread. Sections 5.2 and 5.3 examine these two conditions, respectively. Both sections conclude that the respective assumption is not valid.[10] This explains the Table 4 findings that variation in turnover does a relatively poor job in capturing variation in trading costs. To fully capture the effect of funds' trading costs on returns, one must consider all three components of a fund's trading costs, not just turnover. Section 5.4 presents such an analysis.

5.2. Turnover, average spreads, and trading costs

Figure 3 plots the distribution across funds in turnover, T_{jt}, and the average spread of fund holdings $\left(\overline{Spd}_{jt}\right)$. The figure is constructed by independently ranking funds into turnover quintiles and spread quintiles, and then forming a five-by-five partition of the sample of funds according to these quintile rankings. Panel A presents the number of funds in each cell of the five-by-five partition. The area of each dot graphically represents the relative number of funds in the corresponding cell. Panel B presents the average annual spread costs of the funds in each cell, with the area of the dot graphically representing the relative magnitude of that cost. The average turnover of the funds in each turnover quintile is listed in the row headings. Similarly, the average spread of the funds' holdings in each effective-spread quintile is listed in the column heading.

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There are several observations from Fig. 3. First, there is substantial variation in the average spread of holdings across funds. Section 5.1 shows that turnover will be an accurate proxy for trading costs only if trading costs are proportional to turnover (spread sensitivity close to zero) and the proportionality coefficient (the fund's average spread) is constant across funds. Fig. 3 shows that one cannot apply a single proportionality coefficient in relating trading costs to turnover without losing significant explanatory power. Both turnover and the average spread of holdings are important determinants of funds' annual spread costs. For example, the five funds in turnover quintile 1 and spread quintile 5 have average annual spread costs of .46%, a magnitude similar to that for the three funds in the opposite corner, turnover quintile 5 and spread quintile 1, with annual spread costs averaging .57%. There are a number of similar examples in Panel B which demonstrate that a fund's annual spread costs depends on both the frequency of trade and the average spread of the funds' holdings.

Second, in Panel A, the number of funds along the diagonal, where turnover and average spread of holdings are directly related, is surprising. For example, among funds that hold the highest-spread stocks (average spread = 1.28%) the greatest concentration of funds occurs in the highest turnover quintile (average turnover = 1.35). Recall that the quintile rankings are independent, so funds in the high-turnover quintile have high turnover relative to *all* funds, not just relative to other high-spread funds. One might expect that funds holding higher-spread stocks would have relatively lower turnover rates, given that their turnover is particularly costly. For example, Amihud and Mendelson's (1986) discuss a clientele effect whereby investors with short holding periods hold stocks with relatively low spreads and investors with long holding periods hold stocks with relatively high spreads. A similar argument applies to the funds in the

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[10] Chalmers and Kadlec (1998) use similar logic to argue that investors' amortized spread costs are not fully captured by the spread and must consider turnover as well.

lowest spread quintile. Most funds in this quintile are relatively inactive traders, despite the fact that they hold relatively low spread stocks. These patterns are statistically significant: the p-value for the null that there is no association between the row and column variable in Panel A, using a chi-square test, is 0.015.

5.3 Spread sensitivity of trading

The spread sensitivity component of trading costs is negative if trading volume within the fund is inversely related to the spread. We use a summary measure of spread sensitivity (the second term in Eq. (6)) in decomposing trading costs. A more comprehensive measure of spread sensitivity is provided by regressing trading volume on spreads across portfolio holdings. This section focuses on this measure. We have considered many specifications for this regression. All have some disadvantage, econometric or otherwise. However, the conclusions regarding trading behavior are robust across procedures and they collectively provide clear evidence that fund managers are somewhat sensitive to costs imposed by the spread, after controlling for the fund's holdings. For brevity, we present only one of the many methods used to evaluate fund manager's trading sensitivity to spread costs.

For each fund, and each quarter, we estimate a regression where the dependent variable is the volume of trade in various spread categories or bins, and the independent variables are the total portfolio weight of stocks in the bin and the average spread of the stocks in the bin. Using this approach, all stocks held or traded during the quarter are allocated into one of forty bins according to their effective spread. The bins range from a spread of less than 0.20% to 4.0%, with 0.10% increments. The total portfolio weight in each bin is determined, each quarter, as is the total volume of transacting by the fund in each bin, each quarter. Thus, for each fund, and each quarter we estimate a regression with 40 observations. Intuitively, the regressions test

whether the trading activity associated with a stock depends on the spread, after controlling for the fund's tendency to hold such stocks.

Table 6 reports average coefficient estimates from the above regressions. Perhaps not surprisingly, there is a strong association between funds' trading activity and their holdings. That is, if a fund holds more of particular stock it tends to trade it more. The interesting result is the incremental negative relation between trading activity and spread after controlling for holdings. The t-statistic for this relation is –12, and in the various specifications attempted was never less than –4. This indicates that on average, funds pay some attention to the spread in making trading decisions. Thus, this factor is likely to provide information about the fund's overall trading costs.

5.4 Fund returns and the components of trading costs

In results not tabulated we present a regression decomposition of funds' annual spread costs into the three components, turnover, average spread of holdings, and spread sensitivity. The coefficient estimates are 0.005 (t=42), 0.100 (t=34) and 0.002 (t=4), respectively. This suggests that all three components are important determinants of total trading costs. In this section we examine the relative contribution of the three components in explaining fund returns.

Table 7 reports time-series average coefficient estimates from regressions of fund returns on expense ratios and the three components of spread costs. From Table 7, fund returns retain a negative relation to expense ratios, though not as significantly as in the regressions of Table 5. As in Carhart (1997), we find that fund returns are negatively related to fund turnover, although the significance is generally marginal. The average coefficient estimate for turnover are –.02 (t-statistic=-1.46), -.02 (t-statistic=-1.84), and -.03 (t-statistic=-2.60) for the regressions using raw returns, CAPM-adjusted returns, and Carhart-adjusted returns, respectively.

We also find evidence that the other components of spread costs, average spread of holdings, and spread sensitivity, help to explain fund returns. For example, the coefficient estimate for average spread of holdings is negative in all three regressions and significant in the regressions using raw returns and CAPM-adjusted returns. In particular, the average coefficient estimate for average spread of holdings are –.96 (t-statistic=-1.76), -1.47 (t-statistic=-2.83), and -0.12 (t-statistic=-0.55) for the regressions using raw returns, CAPM-adjusted returns, and Carhart-adjusted returns, respectively. The coefficient estimate for spread sensitivity is also negative in all three regressions, though it insignificant in each of the three regressions. From this analysis we conclude that there is weak explanatory power to the non-turnover components of trading costs.

6. Investment objectives and fund costs

Fund investment objective classifications are an important descriptor of mutual funds. However, they are inherently subjective. Brown and Goetzman (1997) attack the subjective nature of the classification system by examining the returns of mutual funds and classifying them by their return characteristics, arguing that these are much more objective measures by which funds can be categorized. Given the strong explanatory power for performance, it strikes us that the expense ratios and trading costs that funds impose on investors provide useful measures by which funds can be characterized. With this in mind, we provide evidence on the question: to what extent is cross sectional variation in total fund costs, expense ratios and trading costs, explained by existing investment-objective classifications?

Table 8 provides statistics on costs broken down by CRSP's 1987 investment objectives for our sample funds. In Panel A fund characteristics, most importantly the expense ratio and trading costs, are presented. There is some variation in total costs across investment

objectives, particularly for maximum capital gains and growth categories. However, in comparing this range of explained variation to Table 4 it is apparent that existing objective classifications have little association with costs and that most of the cross sectional variation in costs occurs within objectives instead of across objectives. To highlight this point, the 25th – 75th percentile ranges for total fund costs (not reported in Table 8) are 159 bp to 254 bp for Maximum capital gain, 149 bp to 231 bp for Growth funds, and 105 to 178 for Growth and Income funds. The large variation within investment objective supports the notion that classification based upon trading costs provides valuable information beyond that provided by the investment objective.

Table 8 Panel B summarizes the characteristics of the stocks held by investment objective. The investment objectives do appear to correspond with stock characteristics in the manner that one might expect. For example, average effective spreads are .59% maximum capital gain and .49% for growth funds while the stocks that Growth and Income funds own have average effective spreads of .35%. In addition, the other stock characteristic variables conform to the observation that more risky stock attributes are associated with maximum capital gain and growth objectives. Even so, the riskiest objective holds very large stocks, size rank of 8.6, with low effective spreads (rank=2.8), below median standard deviations (rank = 4.3), and above median dividend yields (rank=6.1).

7. Conclusions

We estimate the costs of fund managers' trades and find these costs to have a substantial negative association with return performance. There are many interesting contexts in which to interpret the evidence in our paper. Grossman and Stiglitz (1980) suggest that an informed trader will not trade in stocks where the expected value of the information is less than the costs

of executing the trade. One interpretation of our evidence is that mutual fund managers do not follow this rule. Alternatively, it could be that much of the trading costs we observe are related to the provision of liquidity as discussed in Edelen (1999). To the extent that this trading is unavoidable, the negative association between fund returns and trading costs suggests that it pays to have fund managers' who mitigates the cost of such trades. Finally, a plausible, although unlikely interpretation for our results is that poor returns cause higher trading costs because investors leave funds with poor returns which generates additional trading costs. We find this unlikely because inflows also create liquidity costs and Sirri and Tufano (1998) and Del Guercio and Tkac (1999) find that inflow tends to follow good performance, while fund outflows are relatively insensitive to fund returns.

A practical issue that arises from our analysis is that it is costly to obtain direct estimates of funds' trading costs. Given their importance in explaining fund returns, a low cost proxy for trading costs may be valuable. Our evidence suggests that a truly discriminating proxy needs to go beyond turnover. Unfortunately, the other two components of trading costs, the weighted-average spread and cost sensitivity of trading, are not readily observable. Thus, the search for a low-cost proxy for these components would have significant practical value.

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Table 1
Comparison of sample funds to the CRSP mutual-fund database

For purposes of comparison, we identify all funds in the CRSP database in 1987 with an investment objective that includes common stock. Specifically, we drop funds with investment policy identifications of money market, government securities, C & I, Bonds, Tax-free money market, preferred, and bond and preferred. We also drop funds with no policy classification and less than 50% stock holdings. After these deletions we are left with 341 funds. In this comparison we drop 40 of our 132 sample funds because those sample funds do not pass the 50% equity screen in 1987. The column labeled CRSP is the 341 funds in the CRSP universe. Dead funds refer to funds that are merged or liquidated prior to December 1998. Turnover, is the ratio of the funds annual sales to assets. Expenses are expense ratios reported by CRSP. Returns are arithmetic averages of the annualized quarterly returns in 1987. Assets, is the average monthly total net asset value reported in CRSP.

Fund objective	CRSP	Our Sample	Year of inception	CRSP	Our Sample
Maximum Capital Gains	16%	21%	Before 1980	47%	52%
Growth	46%	35%	1980 to 1985	32%	27%
Growth & income	24%	29%	1985	6%	8%
Income	8%	10%	1986	5%	5%
I-G	6%	5%	1987	10%	8%
Other characteristics			Dead funds		
Ratio of equity to assets	84%	83%	No	89%	89%
Turnover	87%	86%	Yes	11%	11%
Expenses	.99%	0.92%			
Returns	7.85%	7.14%			
Assets (millions)	490	513			

Table 2
Characteristics of sample funds and their holdings

Panel A: Sample funds
Fund assets represent total assets under management, as reported by CDA (quarterly observations). Equity / Fund Assets is the average equity value held by the fund divided by fund value reported by CDA. Fund returns are annualized monthly data from CRSP. Turnover is annual fund sales divided by fund assets. Inflow and outflow are the annual cash flows into and out of the mutual funds scaled by fund assets.

N=132 Funds.	Mean	10%	25%	Median	75%	90%
Fund assets (millions)	374	35	68	153	468	1,085
Equity / Fund Assets	.81	.62	.73	.85	.90	.94
Fund returns (%)	13.2	3.9	10.0	13.9	16.8	22.4
Turnover	.76	.27	.45	.70	.99	1.45
Inflow (N = 126 Funds)	.39	.09	.16	.25	.48	.76
Outflow (N =126 Funds)	.40	.14	.19	.27	.42	.69

Panel B: Stocks held by sample funds
Number of stocks is the average number of stocks held in the fund portfolio each quarter. Standard deviation is the annualized monthly standard deviation of return. Effective spread is the transaction-size-weighted average effective spread of each stock over the quarters in which the stock is held. Prior year return is the raw return of the stock in the year prior to the observation. All rank variables are relative to an equal-weighted decile ranking of the universe of stocks available on CRSP (NYSE/AMEX/NASDAQ) (1 low, 10 high).

N=132 Funds	Mean	10%	25%	Median	75%	90%
Number of Stocks	82	39	55	73	98	132
Market Value Equity (millions)	4,662	547	2,514	4,804	7,608	8,674
Rank	9.2	7.0	7.9	8.5	8.8	8.9
Price	39	23	33	40	46	51
Rank	8.7	7.6	8.3	8.9	9.3	9.6
Standard Deviation of return	.36	.27	.30	.34	.39	.47
Rank	3.6	2.2	2.7	3.3	4.2	5.3
Dividend Yield	3.0%	1.0%	1.9%	3.0%	4.0%	4.6%
Rank	7.0	5.0	6.0	7.3	8.0	8.7
Effective Spread	.46%	.29%	.33%	.40%	.50%	.62%
Rank	2.11	1.3	1.5	1.8	2.4	3.2
Beta	1.03	.80	.90	1.01	1.15	1.28
Rank	5.35	4.2	4.8	5.3	6.0	6.6
Prior year return	.20	.10	.14	.18	.26	.35
Rank	6.8	6.1	6.4	6.7	7.1	7.5
Book-to-market	.62	.45	.51	.62	.72	.78
Rank	5.1	4.0	4.5	5.2	5.8	6.3

Table 3
Fund expenses, trading costs and capital gains

All data expressed as annual percent of fund assets. Expense ratio is annual expenses scaled by fund assets as reported by CRSP and does not include sales charges (loads) or brokerage commissions. Spread costs are effective spreads times dollar trade size summed over all trades in a given year, for a given fund, scaled by fund assets. Brokerage commissions are observed semi-annually and reported on an annualized basis. We estimate data on brokerage commissions for 33 of 132 funds. Total fund costs is the sum of the expense ratio, spread costs, and brokerage commissions. Realized gains measures the annualized capital gains realized during the period. Total gain is the hypothetical capital gain if all positions were liquidated. Correlations are calculated by first averaging over time each fund's data, then computing the correlation across funds.

Data (% of fund assets)	Mean	10%	25%	Median	75%	90%
Expense ratio	1.07	.66	.80	1.03	1.28	1.49
Spread costs	.47	.15	.25	.39	.62	.88
Brokerage commissions	.31	.10	.18	.28	.42	.54
Spread + Brokerage	.78	.30	.44	.70	1.03	1.37
Total Fund Expenditures	1.85	1.01	1.35	1.74	2.28	2.76
Realized gains	5.32	.09	2.58	4.95	8.01	12.07
Total gain	9.57	.45	5.49	9.77	14.26	19.38

Correlation

	Expense ratio	Spread costs
Brokerage commissions	.52	.53
Spread costs	.37	
Spread + commissions	.52	

Table 4
Average fund returns by cost quintiles

All data expressed in annual terms.   Funds are assigned to quintiles each quarter on the basis of total cost, trading costs, expense ratios and turnover (1=low). The table presents the average value of the indicated variable within quintile sub-samples. Total cost is the sum of expense ratios, spread costs, and brokerage commissions. Spread costs are effective spreads times dollar trade size summed over all trades in a given year, for a given fund, scaled by total equity. Carhart adjusted returns are raw fund returns minus the predicted return from the four-factor model presented in Carhart (1997). CAPM adjusted returns are raw fund returns minus the expected return from the CAPM. T-statistics are reported which test the hypothesis that the mean quintile 1 value minus the mean quintile 5 value is zero. The turnover quintiles exclude 4.6% of the observations because of missing CRSP turnover. Below the panels the mean value across all observations is reported for the sum of the adjusted return measures and total fund costs. The t-statistic for this value tests the null that the sum is zero. ** p-value < .05, * p-value < .10.

| | Total Fund Cost Quintile | | | | | t-statistic | Trading Cost Quintile | | | | | t-statistic |
	1	2	3	4	5	(Q1-Q5)	1	2	3	4	5	(Q1-Q5)
Expense Ratio	0.65%	0.86%	1.03%	1.15%	1.40%	-60.00**	0.76%	0.95%	1.04%	1.11%	1.24%	-36.73**
Spread Cost	0.16%	0.33%	0.45%	0.66%	1.18%	-63.51**	0.13%	0.29%	0.45%	0.67%	1.23%	-72.93**
Brokerage commissions	0.09%	0.17%	0.26%	0.37%	0.55%	-64.34**	0.08%	0.16%	0.25%	0.38%	0.56%	-68.73**
Total Costs	0.90%	1.36%	1.74%	2.18%	3.12%	-112.94**	0.97%	1.40%	1.74%	2.16%	3.03%	-94.71**
Carhart Adjusted Returns	-0.77%	-0.87%	-1.04%	-1.73%	-4.38%	4.34**	-0.25%	-0.94%	-0.87%	-3.09%	-3.62%	4.06**
CAPM Adjusted Returns	-0.41%	-1.75%	-1.52%	-2.32%	-6.26%	6.24**	0.06%	-1.68%	-1.68%	-3.68%	-5.25%	5.64**
Returns	14.52%	13.42%	13.93%	12.66%	9.76%	1.95*	14.14%	13.89%	14.06%	11.88%	10.31%	1.60

| | Expense Ratio quintiles | | | | | t-statistic | Turnover Quintiles | | | | | t-statistic |
	1	2	3	4	5	(Q1-Q5)	1	2	3	4	5	(Q1-Q5)
Expense Ratio	0.59%	0.81%	0.99%	1.15%	1.55%	-91.18**	0.81%	0.91%	1.01%	1.15%	1.18%	-27.71**
Spread Cost	0.35%	0.42%	0.52%	0.73%	0.76%	-24.02**	0.24%	0.38%	0.53%	0.66%	0.96%	-47.34**
Brokerage commissions	0.16%	0.22%	0.28%	0.33%	0.44%	-32.36**	0.11%	0.17%	0.28%	0.35%	0.51%	-53.59**
Total Costs	1.10%	1.45%	1.79%	2.21%	2.74%	-64.75**	1.16%	1.47%	1.82%	2.15%	2.65%	-58.59**
Carhart Adjusted Returns	-1.31%	-1.70%	-1.06%	-1.11%	-3.63%	2.79**	-1.10%	-1.32%	-1.51%	-1.88%	-2.52%	1.59
CAPM Adjusted Returns	-1.01%	-1.95%	-1.57%	-2.75%	-4.98%	4.20**	-3.28%	-2.05%	-2.13%	-2.30%	-2.82%	-.45
Returns	14.50%	13.04%	12.67%	13.12%	10.97%	1.44	11.87%	13.23%	13.67%	13.46%	12.18%	-.13

Mean Carhart adjusted return + total fund costs = .11%, t-statistic=.43
Mean CAPM adjusted return + total fund costs = -.59%, t-statistic=-2.12*

Table 5
Expenses, spread costs and fund returns

Coefficients reported below are time-series averages of coefficients from 64 cross-sectional regressions of monthly fund returns on expenses and spread costs following Fama-MacBeth (1973). Raw fund returns are unadjusted fund returns. The returns are measured net of fund expenses, fees, and transaction costs (excluding load fees). CAPM-adjusted returns are raw fund returns minus the expected return as specified by the CAPM. Carhart-adjusted returns are raw fund returns minus the expected return as specified by a four factor model used in Carhart (1997). Expenses are the funds expense ratio from CRSP. Spread costs are the expenditures we estimate the fund has made on bid-ask spread related costs scaled by equity value. * indicates p-value < 10% and ** indicates the p-value < 5%.

Independent variables	Raw Fund Returns	CAPM-adjusted Returns	Carhart-adjusted Return
Intercept	.01**	.002**	.002**
	(2.5)	(2.93)	(2.22)
Expenses	-1.72*	-2.22**	-1.77**
	(-1.74)	(-2.72)	(-2.90)
Spread Expenditures	-3.43*	-5.21**	-3.22**
	(-1.98)	(-3.20)	(-2.95)
N (cross-sections)	64	64	64

Table 6
The relation between trade choice, spreads, and portfolio weights

For each fund, in each quarter, we place all stocks held or traded during the quarter into one of forty bins according to the stock's effective spread. The bins range from a spread of less than 0.20% to 4.0%, with 0.10% increments. We sum the portfolio weight of all of a given fund's stocks in each bin and sum the trading activity for each bin where buys and sells are both positive numbers. Regressions are estimated separately for each fund, each quarter. There are 40 observations in each regression. The regressions estimate the relation between summed trading and the summed holdings and the midpoint of the bin's spread range. The coefficient estimates for each quarter are first averaged across all quarters of data for each fund. The panel presents the distribution of the average coefficient estimates across the 132 sample funds.

Mean:	*estimate*	*t-statistic*	10%	25%	Median	75%	90%
Intercept	.21	8.5	.05	.09	.17	.24	.37
Spread	-1.02	-12.5	-2.3	-1.65	-.86	-.34	.11
Portfolio weight	.43	405	.24	.32	.41	.53	.72

Table 7
Fund returns and the components of spread costs

Coefficients reported below are time-series averages of coefficients from 64 cross-sectional Fama-MacBeth (1973) regressions of monthly fund returns on expenses, turnover, average effective spread of holdings, and the spread sensitivity. Raw fund returns are unadjusted fund returns. Fund returns are measured net of fund expenses, fees, and transaction costs, excluding load fees. CAPM-adjusted returns are raw fund returns minus the expected return as specified by the CAPM. Carhart-adjusted returns are raw fund returns minus the expected return as specified by a four factor model used in Carhart (1997). Expenses are the funds expense ratio from CRSP. Fund turnover is estimated from the CDA data and is measured as the average of purchases plus sales divided by fund assets. Average spread is the value-weighted average effective spread of the fund's stock holdings. Spread sensitivity is defined in eq. (6) and measures the tendency of the fund manager to trade stocks that are more or less costly to trade than the average stock that the fund holds. * indicates p-value < 10% and ** indicates the p-value < 5%.

Independent variables	Raw Fund Returns	CAPM-adjusted Returns	Carhart-adjusted Return
Intercept	.02**	.005**	.002**
	(2.99)	(2.81)	(2.01)
Expenses	-.81	-1.17	-1.81**
	(-.97)	(-1.60)	(-2.79)
Fund Turnover	-1.90	-.02*	-.03**
	(-1.46)	(-1.84)	(-2.60)
Average Spread	-.96*	-1.47**	-.12
	(-1.76)	(-2.83)	(-.55)
Spread Sensitivity	-.05	-.07	-.03
	(-.87)	(-1.33)	(-.61)
N (cross-sections)	64	64	64

Using the CRSP fund objective codes from 1987 we characterize the average values of funds broken down by investment objective. Ranks are computed annually relative to the universe of available data in each year. The investment objective we call aggressive growth is classified by CRSP as maximum captital gains and I-G appears to be synonymous with an investment style of balanced.

Panel A: Fund characteristics by investment objective

Fund characteristics	Aggressive Growth	Growth	Growth & Income	Income	I-G
Number of funds	32	48	33	11	8
Fund Assets (millions)	365	281	527	427	265
Fund Return	14.1%	13.4%	13.9%	8.4%	12.6%
Expense ratio	1.15%	1.13%	0.95%	0.98%	0.96%
Spread Cost	0.65%	0.51%	0.35%	0.34%	0.16%
Brokerage Commission	0.35%	0.35%	0.26%	0.29%	0.14%
Total Fund Costs	2.15%	1.99%	1.56%	1.61%	1.39%
Realized Capital Gains	2.73%	6.61%	6.76%	4.56%	2.97%
Total Gains	6.81%	11.75%	11.89%	2.21%	8.04%
Turnover	.94	.77	.63	.88	.65
Ratio of Equity to Assets	.83	.83	.83	.83	.56
Fund Inflows	.46	.48	.25	.35	.25
Fund Outflows	.47	.51	.25	.26	.25

Panel B: Stock holdings' characteristics by investment objective

All rank variables are relative to an equal-weighted decile ranking of the universe of stocks available on CRSP (NYSE/AMEX/NASDAQ) with 1 low and 10 high. Number of stocks is the average number of stocks held in the fund portfolio each quarter. Standard deviation is the annualized monthly standard deviation of return. Effective spread is the average effective spread for the stocks held by each fund. The effective spread for each stock is a transaction-size-weighted average effective spread over the quarter in which the stock is held by any fund. Prior year return is the raw return of the stock in the year prior to the observation.

Stock Holdings'	Aggressive Growth	Growth	Growth& Income	Income	I-G
Number of stocks held	94	89	71	81	47
Market Value Equity (mil)	2,781	3,715	6,396	6,181	8,636
Rank	8.6	9.1	9.6	9.6	9.8
Price	36.27	35.84	44.60	41.08	47.03
Rank	8.0	8.5	9.2	9.0	9.4
Standard Deviation of Return	.40	.38	.31	.31	.27
Rank	4.3	4.0	2.9	2.8	2.3
Dividend yield	2.06%	2.62%	3.62%	4.44%	4.16%
Rank	6.1	6.5	7.9	8.4	8.5
Effective spread	.59%	0.49%	0.35%	.37%	.30%
Rank	2.8	2.3	1.6	1.7	1.4
Prior year return	.22	.23	.19	.15	.15
Rank	6.6	6.8	6.8	6.5	6.9
Book-to-Market	.59	.57	.66	.74	.67
Rank	4.9	4.9	5.4	5.9	5.5
Beta	1.1	1.1	.9	.9	.8
Rank	5.9	5.7	4.8	4.7	4.3

Information not in table but used in text.

Note: 25th to 75th percentile for total fund expense in MCG is 159 bp to 254
G   is 149 bp to 231
G-I   is 105 bp to 178

Information not in table but used in text.

Note: 25th to 75th percentile for total fund expense in MCG is 159 bp to 254
G   is 149 bp to 231
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Fig. 1. Distribution of fund observations
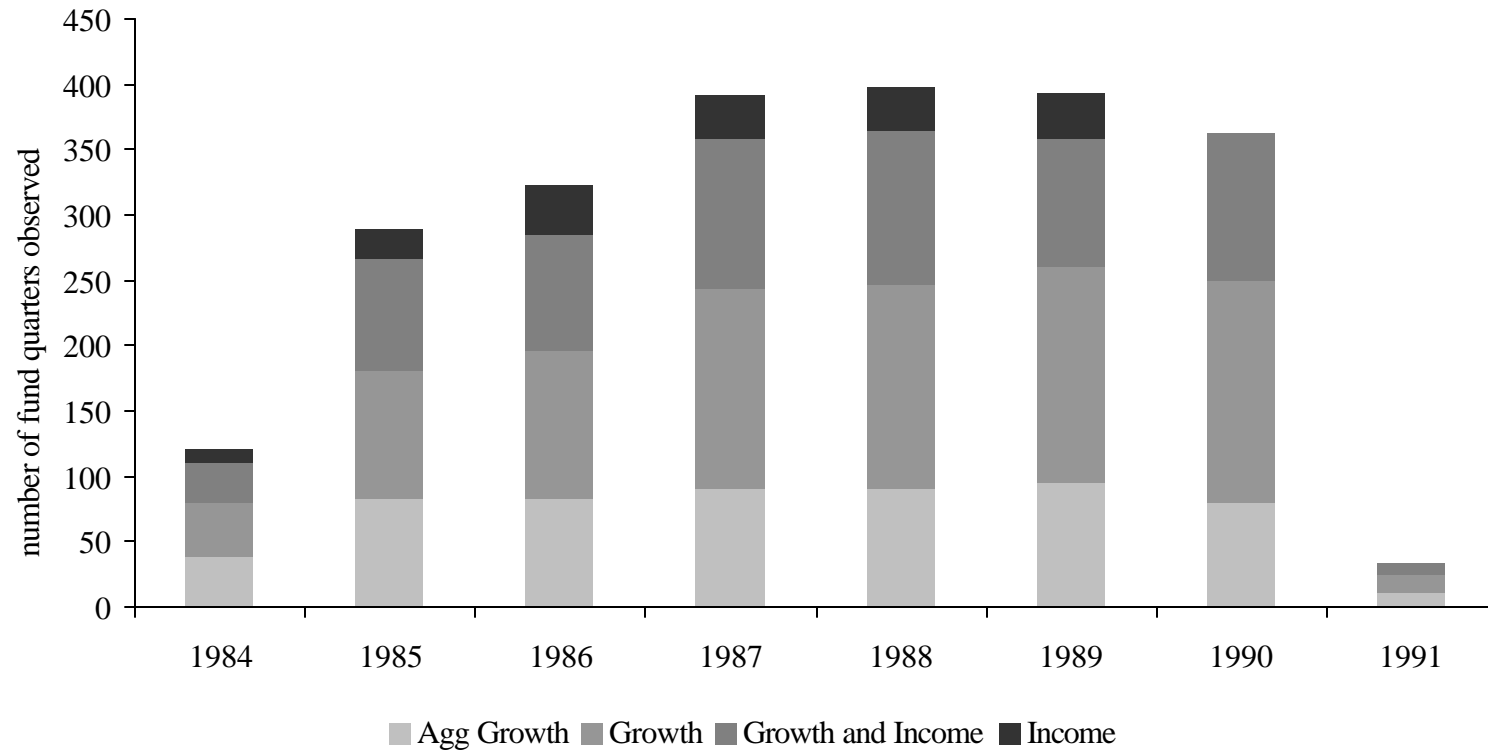The number of fund quarters observed in each year distinguished by the investment objective of the fund.

Fig. 2. Fund costs and fund size

Data to assess the relation between fund size and fund costs are presented in Panels A and B.

Panel A   The sample of 132 funds is sorted annually by average assets under management and placed into size quartiles. For each quartile average expenses ratios, brokerage commissions, and spread costs are calculated for the year. The bars represent the average values of the cost variables by size quartile. For 33 funds, missing brokerage commissions are replace by estimates from a cross-sectional regression of brokerage commissions on spread costs, turnover, and the expense ratio using the 99 funds with brokerage commission data.
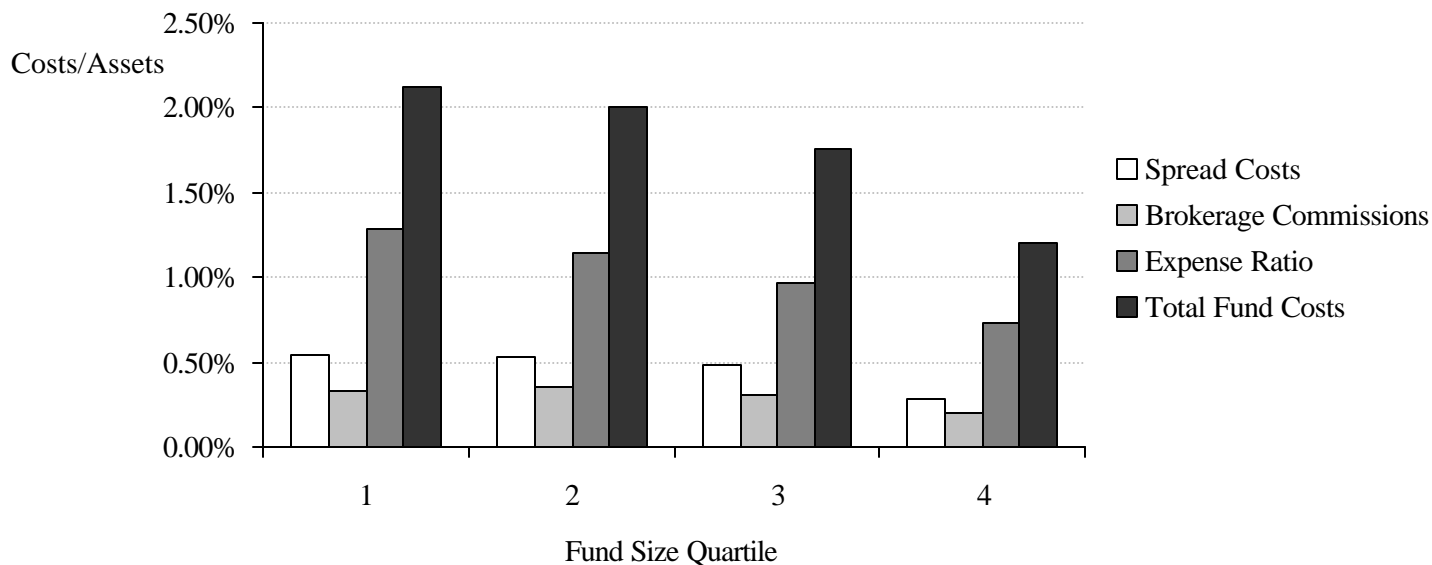
Panel B. Each year we average each fund's assets under management, spread costs, brokerage commissions, expense ratio and total fund costs. We present the cross-sectional correlation between assets under management and each of the cost variables. The average reflects the average over time of the cross-sectional correlation estimates. The number of funds in each correlation estimate is provided in the rightmost column.

| Year | Correlation between Assets under management and | | | | |
	Spread Cost	Brokerage Commissions	Expense Ratio	Total Fund Costs	Number of Funds
1984	-0.22	-0.27	-0.57	-0.41	70
1985	-0.26	-0.17	-0.56	-0.43	86
1986	-0.33	-0.22	-0.55	-0.45	97
1987	-0.35	-0.33	-0.48	-0.49	116
1988	-0.31	-0.32	-0.50	-0.47	120
1989	-0.31	-0.30	-0.46	-0.46	121
1990	-0.32	-0.28	-0.52	-0.45	114
1991	-0.48	-0.53	-0.83	-0.49	24
Average Correlation	**-0.32**	**-0.30**	**-0.56**	**-0.45**	

Fig. 3. Spread expenses, average spread of holdings and turnover.
Each fund is assigned an independent turnover and spread quintile. The quintile is established by first ranking funds each year, independently, according to turnover and average effective spread of fund's holdings. The ranks are then averaged across the entire sample period for each fund. Within quintile-by-quintile sub-samples, we compute the average spread expense, and the number of funds falling into each of cell. The area of each circle represents the average value of the variable of interest for funds falling into each turnover rank - spread rank cell. The arrows begin at quintile 1 and point in the direction of increasing spread and turnover ranks. Average turnover of funds by turnover quintiles is noted on the horizontal axis and average effective spreads of spread quintiles are noted on the vertical axis.

Panel A: Number of Funds

Panel B: Spread costs