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Mutual Fund Performance: An Empirical Decomposition into Stock-Picking Talent, Style, Transactions Costs, and Expenses

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ABSTRACT

We use a new database to perform a comprehensive analysis of the mutual fund industry. We find that funds hold stocks that outperform the market by 1.3 percent per year, but their net returns underperform by one percent. Of the 2.3 percent difference between these results, 0.7 percent is due to the underperformance of nonstock holdings, whereas 1.6 percent is due to expenses and transactions costs. Thus, funds pick stocks well enough to cover their costs. Also, high-turnover funds beat the Vanguard Index 500 fund on a net return basis. Our evidence supports the value of active mutual fund management.

DO MUTUAL FUND MANAGERS WHO actively trade stocks add value? Academics have debated this issue since the seminal paper of Jensen (1968). Although some controversy still exists, the majority of studies now conclude that actively managed funds (e.g., the Fidelity Magellan fund), on average, underperform their passively managed counterparts (e.g., the Vanguard Index 500 fund).[1] For example, Gruber (1996) finds that the average mutual fund underperforms passive market indexes by about 65 basis points per year from

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[1] Interestingly, the two largest funds in the United States, as of November 30, 1999, are the actively managed Fidelity Magellan Fund and the passively managed Vanguard Index 500 fund. Each fund manages roughly $97 billion. See www.investorhome.com/magic/ for updates on the relative fortunes of these two bellwether funds. Also of interest is the introduction of index funds by Fidelity and actively managed funds by Vanguard.

1985 to 1994. Also, Carhart (1997) finds that net returns are negatively correlated with expense levels, which are generally much higher for actively managed funds. Worse, Carhart finds that the more actively a mutual fund manager trades, the lower the fund's benchmark-adjusted net return to investors. These studies do not provide a promising picture of active mutual fund management—instead, the studies conclude that investors are better off, on average, buying a low-expense index fund.[2,3] Yet, investors continue to pour money into actively managed funds in pursuit of performance.

Using a different approach, some recent studies look at the performance of the *stocks* held in mutual fund portfolios. The results of these papers are somewhat at odds with the studies mentioned above—indeed, these studies conclude that managers that actively trade possess significant stock-picking talents. For example, Grinblatt and Titman (1989, 1993) and Wermers (1997) conclude that mutual fund managers have the ability to choose stocks that outperform their benchmarks, before any expenses are deducted. The evidence is especially strong among growth-oriented funds, which hold stocks that outperform their benchmarks by an average of two to three percent per year, before expenses. Meanwhile, Daniel et al. (1997) and Grinblatt, Titman, and Wermers (1995) attribute much of this performance to the characteristics of the stocks held by funds. For example, funds using value-investing strategies hold stocks with higher average returns than passive stock indexes. However, a recent paper by Chen, Jegadeesh, and Wermers (2000) that examines trades of funds rather than holdings shows that funds, in aggregate, tend to *buy* stocks that outperform the stocks they *sell* by two percent per year, adjusted for the characteristics of these stocks.

Because the industry-average mutual fund expense ratio (weighted by the total net assets of funds) is roughly 100 basis points per year, compared to a ratio of roughly 20 basis points per year for the Vanguard Index 500 fund, the debate has important implications for the future of the mutual fund industry. Mutual funds now manage over $3 trillion in equities; thus, an 80 basis-point difference in expense ratios between active and passive funds amounts to an additional expenditure of over $20 billion per year on active fund management. In addition, actively managed funds incur substantially higher trading costs than index funds. Given the magnitude of these costs, it is important to determine whether the industry as a whole (or perhaps industry subgroups) has stock-picking talents that justify the trading costs it incurs and the management fees and expenses that it charges.

In this paper, we employ a new database that allows a comprehensive look at the performance of the mutual fund industry at both the stock holdings level and the net returns level. With this database, we empirically decom-

[2] The issue of whether *subgroups* of actively managed funds consistently outperform their benchmarks is more controversial. See, for example, Brown and Goetzmann (1995), Grinblatt and Titman (1992), Hendricks, Patel, and Zeckhauser (1993), and Carhart (1997).

[3] A good deal of recent media attention has been given to the alleged underperformance of actively managed mutual funds, too. See, for example, Clements (1999).

pose performance into several components to analyze the value of active fund management. With this performance decomposition, we provide a more precise analysis of active versus passive management and address the sources of disparity between mutual fund studies that examine stock holdings and studies that examine the net returns of funds.

For example, mutual funds tend to systematically follow certain "styles," such as holding small stocks or high past-return stocks (see, e.g., Chen et al. (2000)). Indeed, Grinblatt, Titman, and Wermers (1995) find that the majority of mutual funds tend to actively invest in high-past-return stocks (these investment strategies are called "momentum-investing" or "trend-following" strategies). Past research (e.g., Fama and French (1992, 1996), Jegadeesh and Titman (1993), Daniel and Titman (1997), and Moskowitz and Grinblatt (1999)) provides evidence that stocks with certain characteristics (e.g., high book-to-market or momentum stocks) outperform other stocks, at least before trading costs are deducted. Given this evidence, we might expect that mutual funds employing such styles would achieve higher average portfolio returns—however, in practice, they might not deliver superior net returns to investors due to the possibly high costs of analyzing and implementing these styles.

We address these issues by decomposing mutual fund returns and costs into several components. Our analysis is made possible by merging two comprehensive mutual fund databases. The first database contains quarterly snapshots of the equity holdings of mutual funds from 1975 to 1994, whereas the second database contains monthly net returns, along with yearly expense ratios, turnover levels, and other fund characteristics over the same time period. We merge these two databases to create a comprehensive mutual fund research database. Both of the source databases are free of survivorship bias—the merged database is also essentially free of survival bias, as almost every diversified equity mutual fund in the two source databases is included in the merged dataset.

One advantage of our study is conferred by the stock holdings data. A recent paper by Daniel et al. (1997) develops precise return benchmarks for stocks, based on the size, book-to-market, and momentum characteristics of those stocks. The benchmarks developed in Daniel et al. (1997), along with our stock holdings data for a given fund, allow a precise characterization of the style used by the fund manager in choosing stocks. This, in turn, allows the precise design of benchmarks that control for that style.[4] In addition,

[4] We remain agnostic about whether fund managers should be rewarded for holding stocks with certain characteristics (e.g., momentum stocks) during long periods of time when those stocks outperform the market. Indeed, this issue is currently being debated in the finance literature (see, e.g., Fama and French (1992, 1996) and Daniel and Titman (1997)). However, controlling precisely for a given style allows an accurate decomposition, at the stock-selection level, of performance that is attributable to such a style as opposed to that due to stock-picking talents in excess of the manager's chosen long-term style. The investor is then left to judge whether funds should be rewarded for achieving characteristic-based returns or solely for returns net of characteristics.

periodic stock holdings allow the estimation of trading costs, based on recent research by Keim and Madhavan (1997) on the total execution costs of institutional investors. Finally, our data on the expense ratios and net returns of a fund allow an analysis of the other frictions involved when the fund manager actually implements a chosen style and/or stock-picking program. Such a precise analysis was not possible with databases previously available, which contained either stock holdings data or net returns but not both.

With our new merged database, we empirically decompose the returns and costs of each mutual fund into that attributable to (1) skills in picking stocks that beat the returns on the portfolio of all stocks having the same characteristics, (2) returns that are attributable to the characteristics of stock holdings, (3) trade-related costs of implementing the manager's style and/or stock-picking program, (4) fund expenses incurred and fees charged for managing the portfolio, and (5) differences between gross stock portfolio returns and net fund returns that are due to holdings of cash and bonds versus stocks by the fund. Our analysis, therefore, provides a deeper understanding of the costs and benefits of active mutual fund management.

Our results indicate several trends over the 20-year period in the U.S. equity mutual fund industry. First, growth-oriented funds have become the most popular sector of the mutual fund universe, most likely because of the relatively high returns of growth stocks over this period. Second, the mutual fund industry has moved toward becoming more fully invested in common stocks, as opposed to bonds and cash—this tendency generally benefited funds during the 1990s.

Third, the trading activity of the average mutual fund has more than doubled from 1975 to 1994. Although trading has substantially increased, annual trading costs (per dollar invested in mutual funds) in 1994 are one-third their level in 1975. Certainly, the general decrease in transactions costs in the various markets contributed significantly to this trend; however, it is also likely that funds are able to execute trades more carefully with the increased level of technology in use in mutual fund complexes. And, finally, average expense ratios in 1994 (as a percentage of assets) are somewhat higher than their 1975 level, mainly due to the larger proportion of new, small funds in 1994, but also due to the substitution of 12b-1 fees for load fees during the 1990s.

In our analysis of mutual fund returns, we find that mutual funds, on average, hold stocks that outperform a broad market index (the CRSP [Center for Research in Securities Prices] value-weighted index) by 130 basis points per year—this is roughly the magnitude of their expenses and transactions costs combined. Indeed, during 13 out of 20 years, the average mutual fund (weighted by the total net assets under management) held a stock portfolio that beat the S&P 500 return (before transactions costs).

Our decomposition of fund returns provides insight into the sources of this 130 basis point per year outperformance. First, the funds chose stocks that outperformed their characteristic benchmarks by an average of 71 basis points per year. In addition, funds held stocks having characteristics associated with average returns that were higher than the return on broad market

indexes during our sample period. Specifically, we estimate that returns associated with these characteristics provided a boost for the funds of 55 to 60 basis points per year above the CRSP index.

Although the average fund held stocks that beat the CRSP index by 130 basis points per year, the average mutual fund net return is 100 basis points per year lower than the CRSP index. Interestingly, the industry average net return matched that of the Vanguard Index 500 fund during this period, although Vanguard has, more recently, produced higher net returns. Of the 2.3 percent per year difference between the return on stock holdings and net returns, about 0.7 percent per year is due to the lower average returns of the nonstock holdings of the funds during the period (relative to stocks).[5] The remaining 1.6 percent per year is split almost evenly between the expense ratios and the transactions costs of the funds. Thus, considering only stock holdings, mutual fund managers hold stocks that beat the market portfolio by almost enough (1.3 percent per year) to cover their expenses and transactions costs (1.6 percent per year), which is consistent with the equilibrium model of Grossman and Stiglitz (1980). We note, however, that if one views the 55 to 60 basis point per year return boost from the characteristics of stock holdings as wholly a compensation for risk, then the funds underperform the market by about 90 basis points per year and the Vanguard Index 500 fund by 87 basis points per year.

Finally, our evidence shows that high-turnover funds, although incurring substantially higher transactions costs and charging higher expenses, also hold stocks with significantly higher average returns than low-turnover funds. At least a portion of this higher return level is due to substantially better stock-picking skills by managers of high-turnover funds, relative to their low-turnover counterparts. Although high-turnover funds exhibit a negative (but statistically indistinguishable from zero) characteristic-adjusted net return, their average unadjusted net return over our sample period significantly beats that of the Vanguard Index 500 fund. The remainder of this paper
is organized in four sections. The construction of our database is discussed in Section I, and our performance-decomposition methodology is discussed in Section II. We present empirical findings in Section III. Finally, we conclude the paper in Section IV.

I. Data

We use two major mutual fund databases in our analysis of mutual fund returns. The first database contains quarterly portfolio holdings for all U.S. equity mutual funds existing at any time between January 1, 1975, and December 31, 1994; these data were purchased from CDA Investment Tech-

[5] This figure is consistent with the funds investing 10 to 15 percent of their portfolios in nonstock assets. The equity premium (large capitalization stocks minus T-bills) over the 1975 to 1994 period is 7.5 percent per year. Edelen (1999) also documents the drag of liquidity-motivated holdings on performance

nologies, Inc., of Rockville, Maryland. The CDA data set lists the equity portion of each fund's holdings (i.e., the shareholdings of each stock held by that fund) along with a listing of the total net assets under management and the self-declared investment objective at the beginning of each calendar quarter. CDA began collecting investment-objective information on June 30, 1980; we supplement these data with investment objective data for January 1, 1975. Further details on the CDA holdings database are provided in Appendix A and in Wermers (1999).

The second mutual fund database is available from CRSP and is used by Carhart (1997). The CRSP database contains monthly data on net returns and annual data on portfolio turnover and expense ratios for all mutual funds existing at any time between January 1, 1962 and December 31, 1997. Further details on the CRSP mutual fund database are provided in Appendix A; documentation is also available from CRSP.

These two databases were merged to provide a complete record of the stock holdings of a given fund, along with the fund's turnover ratio, expense ratio, net returns, investment objective, and total net assets under management during each year of the fund's existence during our sample period. In general, funds were matched between the two databases by matching their fund names, although other fund characteristics were also used. Further details on the process used to match funds are provided in Appendix A. Finally, stock prices and returns are obtained from the CRSP NYSE/AMEX/Nasdaq stock files.

In this study, we limit our analysis to funds that generally hold diversified portfolios of U.S. equities. Specifically, during each quarter, we include only mutual funds having a self-declared investment objective of "aggressive growth," "growth," "growth and income," "income," or "balanced" at the beginning of that quarter.[6] We exclude all other funds, which include international funds, bond funds, gold funds, real estate funds, and all other sector funds, because these types of funds generally hold and trade minimal quantities of domestic equities (if any).

Panel A of Table I provides summary statistics for the merged mutual fund database. In a small number of cases, we could not find a match between funds in the CDA and CRSP files—summary statistics are also provided for these unmatched funds to analyze the potential for biases in our study. Specifically, we show statistics on CRSP mutual funds that could not be matched with a CDA fund, because the reverse situation was rare. We note that the yearly count in the table includes only funds having a complete record containing both CDA holdings and CRSP net returns and characteristics data for a given year. A number of additional funds have incomplete information during each year—this is especially problematic regarding the CDA holdings data for new funds, because holdings data are often missing for the first year or two of a fund's existence. These missing data are unlikely to intro-

[6] See Grinblatt et al. (1995) for a description of the types of investments made by funds in each category.

duce significant biases in our study—nevertheless, our paper focuses on the total net asset weighted performance of the mutual fund industry, which minimizes the significance of any small-fund omissions. This issue is discussed in further detail in Appendix A.

Panel A shows the number of funds in the merged database that exist (and have a complete record of CDA and CRSP data) at the beginning of each year, and the average yearly net return, weighted by the total net assets (TNA) of funds. To minimize any survival requirements, we compute quarterly buy-and-hold net returns for each mutual fund that exists during a given quarter, regardless of whether that fund survives the entire year. These quarterly fund returns are then averaged across all funds existing during that quarter, using each fund's total net assets at the beginning of that quarter as that fund's weight. The TNA-averaged quarterly returns are then compounded into yearly returns. Also, at the beginning of each year, the table shows the median TNA of all funds existing (and having a complete record of CDA and CRSP data) at that time.

The universe of diversified equity mutual funds expanded from 241 funds at the beginning of 1975 to 1,279 funds at the beginning of 1994; the overall total in the merged database is 1,788 distinct funds that existed sometime during the 20-year period. This count includes both funds that survived until the end of 1994 and funds that perished due to a merger or liquidation.[7] As documented in Chen et al. (2000), the proportion of the market value of all U.S. equities (listed in CRSP) held by these funds increased from about 5 percent in 1975 to almost 11 percent in 1994.

Panel A also shows how successful we were in matching the two databases—we matched each mutual fund having an initial listing in the CRSP database before 1991, and having one of the above investment objectives, to a fund in the CDA database. There are 60 funds with an initial CRSP listing during the 1991 to 1994 period that we could not match to a CDA fund—this unmatched sample represents only three percent of our sample of 1,788 matched funds. More relevant to our study, the unmatched sample represents 110 "fund-years," which is about one percent of the almost 10,000 fund-years in our matched sample. These unmatched funds are, in general, much smaller than our matched sample. For example, the median TNA of the unmatched funds existing in 1994 is only $12.6 million, whereas the median TNA of matched funds is $98.5 million. Thus, the economic relevance of these unmatched funds to our study is quite small, especially because we TNA-weight the majority of results in this paper.[8]

[7] This number is slightly smaller than the 1,892 funds reported by Carhart (1997) for the CRSP database. There are a few reasons for this, which we discuss in Appendix A.

[8] As mentioned previously, CDA is slower in adding funds to their database than CRSP, although the completeness of the two databases is comparable (as indicated by our successful matching of the two databases for the vast majority of funds). The small unmatched funds during the last few years of our sample period are likely ones that CDA did not add to their database until after 1994.

Table I

Summary Statistics for Merged Mutual Fund Database

Key statistics are provided below for the merged CDA holdings and CRSP mutual fund characteristics/net returns databases. For each year, statistics are shown at the beginning of the listed year, except as noted in this legend. The CDA database, purchased from CDA Investment Technologies, Inc., includes periodic (usually quarterly) portfolio holdings of U.S. equities for all mutual funds between 1975 and 1994 (inclusive). The CRSP database, purchased from the Center for Research in Securities Prices, contains data on mutual fund net returns, turnover ratios, expense ratios, and other fund characteristics during the same time period. The two databases are merged based on the name and other characteristics of funds. Because CRSP lists net returns and other characteristics for each shareclass of a single mutual fund, these measures are combined based on the relative valuation of the various shareclasses before they are matched to the holdings record for the fund from CDA. Because CDA is slower to add some new funds to its database than CRSP, a number of funds have an incomplete data record each year (they are missing shareholdings data)—these fund-years are not included in our study. In addition, a small number of funds could not be matched (during their entire existence) between the databases during the last few years of our sample period. Panel A provides, each year, fund counts, total-net-asset- (TNA) weighted average yearly net returns, and the median total net assets of the universe of mutual funds contained in the merged database. Every fund existing during a given calendar quarter (and having a complete data record) is included in the computation of that quarter's average net returns, even if the fund does not survive past the end of that quarter (TNA weights are updated at the beginning of each quarter). These quarterly buy-and-hold net returns are compounded to give the quarterly rebalanced annual returns reported below. The panel also provides similar statistics for the CRSP funds that could not be matched (during their entire existence) to a CDA fund. Panel B provides, at the beginning of each listed year, the number of funds and the number of shareclasses represented by those funds in the merged database. Panel C provides fund counts in each investment objective category, in addition to the TNA-average fraction of the mutual fund portfolios that are invested in stocks. In all statistics in all panels of this table, we limit our analysis to funds having a self-declared investment objective of "aggressive growth," "growth," "growth and income," "income," or "balanced" at the beginning of a given calendar quarter. Note, also, that self-declared investment-objective data are available from CDA starting June 30, 1980, so the 1980 figures are as of that date. Before 1980, funds are classified by their investment objectives as of January 1, 1975 (these data were hand-collected from printed sources).

Panel A. Yearly Mutual Fund Universe Statistics

	Merged Database			Unmatched Funds		
Year	Number	TNA-Averaged Net Return (%/year)	Median TNA ($millions)	Number	TNA-Averaged Net Return (%/year)	Median TNA ($millions)
1975	241	30.9	35.5	0	—	—
1976	241	23.0	50.3	0	—	—
1977	226	−2.5	54.5	0	—	—
1978	222	9.0	49.0	0	—	—
1979	219	23.7	44.0	0	—	—
1980	364	31.3	48.9	0	—	—
1981	365	−2.7	44.8	0	—	—
1982	362	24.1	42.1	0	—	—
1983	347	20.4	52.9	0	—	—
1984	372	−0.1	80.3	0	—	—
1985	391	27.8	77.4	0	—	—
1986	418	15.8	98.2	0	—	—
1987	483	2.4	93.0	0	—	—
1988	543	15.9	83.8	0	—	—
1989	589	25.3	75.7	0	—	—
1990	637	−5.3	84.7	0	—	—
1991	679	32.8	78.5	11	25.2	22.4
1992	815	8.2	88.3	14	7.2	25.9
1993	949	14.2	100.1	31	15.6	9.5
1994	1,279	−1.6	98.5	54	−0.01	12.6
1975–1994	1,788	14.6	—	60	12.0	—

continued

Table 1—*Continued*

Panel B. Number of CRSP Mutual Fund Shareclasses in Merged Database

Year	Merged Database	
	Number of Funds	Number of Shareclasses
1975	241	241
1980	364	364
1985	391	391
1990	637	638
1991	679	684
1992	815	831
1993	949	996
1994	1,279	1,377

Panel C. Number of Funds and TNA-Average Stock holdings Percentage, by Investment Objective

	Universe		AG		G		G&I		I or B	
Year	Number	Stocks (%)	Number	Stocks (%)	Number	Stocks (%)	Number	Stocks (%)	Number	Stocks (%)
1975	241	79.9	67	86.9	76	89.1	52	83.8	46	51.0
1980	364	83.8	87	87.1	137	90.7	83	86.9	57	61.6
1985	391	85.4	85	93.4	151	89.5	102	82.0	53	60.8
1990	637	79.8	133	87.3	289	87.8	141	81.2	74	51.4
1994	1,279	82.7	201	92.7	703	90.7	246	82.5	129	54.5

Panel A also compares the TNA-averaged net return on our matched database to that of the unmatched funds. The unmatched funds have generally lower returns, but not appreciably so, which indicates that the upward bias in estimated returns in our study (induced by the exclusion of the unmatched funds) is very small.

Over the past several years, mutual funds have begun to offer different classes of shares in a single mutual fund that appeal to different investor clienteles. These shareclasses confer ownership in the same underlying pool of assets but have differing expense ratios and load fees. For example, one shareclass may offer a low expense ratio and a high load fee to appeal to long-term investors, whereas another class offers a high expense ratio and a low load for short-term investors. The CRSP database lists each shareclass separately, whereas the CDA database lists only the underlying fund. Panel B illustrates the growth in these shareclasses during the 1990s.[9] For example, in 1994, there are 98 more shareclasses than funds, so many funds have several classes of shares. In such cases, we combine the CRSP net returns, expense ratios, percentage of assets held in stocks, and other characteristics of all shareclasses into the corresponding measures for a given fund. In combining these shareclasses, we weight the return or characteristic of each shareclass by the most recent total net assets of that shareclass. Thus, our analysis in this paper uses a mutual fund as the basic unit and not individual shareclasses.

Finally, Panel C presents both the average asset allocation in stocks (versus bonds, cash, and other investments) and a breakdown of our mutual fund universe into the investment objectives that we include in our study.[10] The average fund manager invested almost 80 percent of the fund portfolio in equities in 1975; by 1994, this proportion had increased to almost 83 percent. It is likely that the dismal performance of bonds and cash during this time period provided motivation for the general movement toward becoming more fully invested in stocks.[11] Indeed, we will show, in a later section, that a substantial portion of the underperformance of mutual funds versus stock indexes can be traced to fund investments in nonstock securities.

The panel also shows that the number of growth-oriented funds (aggressive growth and growth funds) has increased much faster than the number of income-oriented funds (growth and income, balanced, and income funds), probably because of the relatively high returns of growth stocks during our sample period. Also noteworthy is how the asset allocations toward stocks

[9] We note that some shareclasses are likely to be underrepresented in the CRSP database—especially shareclasses that are offered solely to institutions. These shareclasses are likely to charge lower expenses and loads, which indicates that we overestimate the weighted-average costs of funds.

[10] In this panel, we combine "income" and "balanced" funds, because these two categories generally contain small numbers of funds and hold similar securities.

[11] As of late, equity mutual funds have been relying less on cash holdings to meet uncertain investor redemptions. Most funds now have lines of credit established with banks and even with other mutual funds. In addition, index funds use options and futures contracts to provide liquidity.

vary across the investment objectives. Growth-oriented funds maintain roughly 90 percent of their portfolios in equities in 1994, while income-oriented funds (true to their investment objectives) maintain lower proportions.

In this paper, we decompose mutual fund returns into several components to analyze the costs and benefits of active mutual fund management. The next section describes the measures we use to decompose the returns generated by the stocks held by a mutual fund. In addition, we describe our method for estimating trading costs for each mutual fund during each quarter.

II. Performance-Decomposition Methodology

The fundamental goal of the manager of an actively managed mutual fund is to consistently hold stocks that have higher returns than an appropriate benchmark portfolio for the stocks. However, in pursuing this objective, the fund manager must consider the costs of finding and trading these stocks, because shareholders of the fund care only about the realized net return. Thus, to understand and to benchmark the performance of an actively managed fund, we develop several measures that quantify the ability of the manager to choose stocks and to generate superior performance at the net return level. These measures, in general, separate the return of the stocks held by a mutual fund into several components both to benchmark the stock portfolio and to understand how the mutual fund manager generated the level of net returns for the fund.

The measures that we employ to decompose the return of a mutual fund include the following:

1. the portfolio-weighted return on stocks currently held by the fund, in excess of returns (during the same time period) on matched control portfolios having the same style characteristics (selectivity),
2. the portfolio-weighted return on control portfolios having the same characteristics as stocks currently held by the fund, in excess of time-series average returns on those control portfolios (style timing),
3. the time-series average returns on control portfolios having the same characteristics as stocks currently held (long-term style-based returns),
4. the transactions costs incurred by the fund,
5. the expense ratio charged by the fund, and
6. the net return to shareholders of the fund, in excess of the return to an appropriate benchmark portfolio.

The first three components above, which decompose the return on the stock holdings before any trading costs or expenses are considered, are briefly described next.[12] We estimate the transactions costs of each mutual fund

[12] These measures are developed in Daniel et al. (1997) and are more fully described there. In that paper, the authors argue that decomposing performance with the use of benchmark portfolios matched to stocks on the basis of the size, book-to-market, and prior-year return characteristics of the stocks is a more precise method of controlling for style-based returns than the method of decomposing performance with factor-based regressions used by Carhart (1997).

during each quarter by applying recent research on institutional trading costs to our stock holdings data—we also describe this procedure below. Data on expense ratios and net returns are obtained directly from the merged mutual fund database. Finally, we describe the Carhart (1997) regression-based performance measure, which we use to benchmark-adjust net returns.

A. The Characteristic Selectivity (CS) Measure

The first component of performance measures the stock-picking ability of the fund manager, controlling for the particular style used by that manager. This measure of stock-picking ability, which is called the "Characteristic-Selectivity" measure (*CS*), is developed in Daniel et al. (1997) and is computed during quarter t as

$$CS_t = \sum_{j=1}^{N} \tilde{w}_{j,t-1}(\tilde{R}_{j,t} - \tilde{R}_t^{b_{j,t-1}}), \tag{1}$$

where $\tilde{w}_{j,t-1}$ is the portfolio weight on stock j at the end of quarter $t-1$, $\tilde{R}_{j,t}$ is the quarter t buy-and-hold return of stock j, and $\tilde{R}_t^{b_{j,t-1}}$ is the quarter t buy-and-hold return of the characteristic-based benchmark portfolio that is matched to stock j at the end of quarter $t-1$.

To construct the characteristic-based benchmark portfolio for a given stock during a given quarter, we characterize that stock over three dimensions–the size, book value of equity to market value of equity ratio, and prior-year return of that stock. Benchmarking a stock proceeds as follows—this procedure is based on Daniel et al. (1997) and is described in more detail in that paper. First, all stocks (listed on NYSE, AMEX, or Nasdaq) having book value of equity information in COMPUSTAT, and stock return and market capitalization of equity data in CRSP, are ranked, at the end of each June, by their market capitalization. Quintile portfolios are formed (using NYSE size quintile breakpoints), and each quintile portfolio is further subdivided into book-to-market quintiles, based on their book-to-market data as of the end of the December immediately prior to the ranking year. Finally, each of the resulting 25 fractile portfolios is further subdivided into quintiles based on the 12-month past return of stocks through the end of May of the ranking year. This three-way ranking procedure results in 125 fractile portfolios, each having a distinct combination of size, book-to-market, and momentum characteristics.[13] The three-way ranking procedure is repeated at the end of June of each year, and the 125 portfolios are reconstituted at that date.

Value-weighted returns are computed for each of the 125 fractile portfolios, and the benchmark for each stock during a given quarter is the buy-and-hold return of the fractile portfolio of which that stock is a member during that quarter. Therefore, the characteristic-adjusted return for a given stock is computed as the buy-and-hold stock return minus the buy-and-hold value-weighted benchmark return during the same quarter. Finally, the Char-

[13] Thus, a stock belonging to size portfolio one, book-to-market portfolio one, and prior return portfolio one is a small, low book-to-market stock having a low prior-year return.

acteristic Selectivity measure of the stock portfolio of a given mutual fund during quarter t, CS_t, is computed as the portfolio-weighted characteristic-adjusted return of the component stocks in the portfolio, where the stock portfolio is normalized so that the weights add to one.

A caveat is in order regarding the interpretation of the *CS* measure, because it controls for only three characteristic dimensions of stocks—size, book-to-market, and past returns. Recent research has shown that mutual funds show a distinct preference for other stock characteristics that are related to average returns—for example, stocks with greater liquidity (see Chen et al. (2000)).[14] For example, one might argue that our *CS* measure underestimates the stock-picking talents of funds because we do not control for the lower average returns that accrue to stocks with greater liquidity.

B. The Characteristic Timing (CT) Measure

The above stock-selectivity measure does not capture the ability of the fund manager to time the various stock characteristics. Indeed, fund managers can generate additional performance if size, book-to-market, or momentum strategies have time-varying expected returns that the manager can exploit by "tilting" portfolio weights toward stocks having these characteristics when the returns on the characteristics are highest. Thus, our second component of performance measures a fund manager's success at timing the different stock characteristics; this component is termed the "Characteristic Timing" (*CT*) measure. The quarter t component of this measure is

$$CT_t = \sum_{j=1}^{N} (\tilde{w}_{j,t-1} \tilde{R}_t^{b_{j,t-1}} - \tilde{w}_{j,t-5} \tilde{R}_t^{b_{j,t-5}}). \tag{2}$$

Note that this expression deducts the quarter t return of the quarter $t - 5$ matching characteristic portfolio for stock j (times the portfolio weight at the end of quarter $t - 5$) from the quarter t return of the quarter $t - 1$ matching characteristic portfolio for stock j (times the portfolio weight at the end of quarter $t - 1$). Thus, a fund manager who increases the fund's weight on stock j just before the payoff to the characteristics of stock j is highest will exhibit a large *CT* measure.

C. The Average Style (AS) Measure

To measure the returns earned by a fund because of that fund's tendency to hold stocks with certain characteristics, we employ our third performance component, the "Average Style" (*AS*) return measure. The quarter t component of this measure is

$$AS_t = \sum_{j=1}^{N} \tilde{w}_{j,t-5} \tilde{R}_t^{b_{j,t-5}}. \tag{3}$$

[14] See Lee and Swaminathan (1998) and Datar, Naik, and Radcliffe (1998) for evidence that more liquid stocks earn lower average returns.

Each stock held by a fund at the end of quarter $t - 5$ is matched with its characteristic-based benchmark portfolio of that date. The quarter t return of this benchmark portfolio is then multiplied by the end of quarter $t - 5$ portfolio weight of the stock, and the resulting product is summed over all stocks held by the fund at the end of quarter $t - 5$ to give the quarter t *AS* component. Note that, by lagging weights and benchmark portfolios by one year, we eliminate returns due to timing the characteristics. For example, a fund that successfully buys high book-to-market stocks when returns to such a strategy are unusually high will not exhibit an unusually high *AS* return, because this strategy will most likely involve moving into stocks within a year before the unusually high book-to-market return. However, a fund that systematically holds high book-to-market stocks to boost its portfolio return (without trying to time the effect) will exhibit a high *AS* Return.

The *AS* measure of a fund may differ from the return on a broad market index for a couple of reasons. First, the *AS* measure may contain a compensation for the fund loading on covariance-based risk factors differently than the market portfolio's loadings. And, second, the *AS* measure may contain return premia for the fund loading on non-covariance-based characteristic factors. We do not attempt to separate these two sources of *AS* return premia in this paper, but we note it and leave the interpretation to the reader (and to further research). Note that the sum of the *CS*, *CT*, and *AS* measures equals the total portfolio-weighted return on the stock holdings of a given fund (we also call this the "gross return" of the fund).[15] Note, also, that computations of the *AS* and *CT* measures begin in 1976 instead of 1975, as we must use one-year lagged portfolio weights to compute these measures.

D. Execution Costs

Keim and Madhavan (1997) provide a detailed examination of execution costs for a sample of mutual funds during the 1991 to 1993 period. Specifically, they estimate the cross-sectional dependence of total institutional trading costs (commissions plus market impact) on the market in which a stock is traded (i.e., NYSE or AMEX vs. Nasdaq), the size of the trade, the market capitalization and price of the stock, and whether the trade was a "buy" or a "sell." The market impact of a given stock trade is measured by comparing the closing price of the stock on the day prior to the trade-decision date to the actual average execution price of the various separate trades that constituted the entire trade "package."

In addition, Stoll (1995) estimates the time-series trend of total execution costs in the different markets. Specifically, the average cost of executing a trade is documented over time both on the NYSE/AMEX and on the Nasdaq. We combine the results of these two papers to allow an estimate of the cost of a specific stock trade by a mutual fund. For example, suppose our holdings data indicate that the Janus 20 fund bought 10,000 shares of IBM on

[15] In practice, this equivalence is only approximately true because of the additional requirement that a stock be listed in COMPUSTAT to be included in the calculation of the CS, CT, and AS measures for a fund.

the NYSE during the first quarter of 1990. We then use these data, along with an estimate of the price and market capitalization of IBM at that time, to apply the execution cost regression of Keim and Madhavan (adjusted using the Stoll factor for the year 1990). The resulting estimate is Janus's cost of buying the shares of IBM. Finally, the Janus 20 fund's total trading costs during the first quarter of 1990 are estimated by summing the cost of all trades during that quarter and dividing by the total value of Janus's stock portfolio at the beginning of that quarter.

Specifically, our equation for estimating the total cost of executing a purchase of stock i during quarter t, $C^B_{i,t}$, as a percentage of the total value of the trade, is

$$C^B_{i,t} = Y^k_t \cdot \Bigg[1.098 + 0.336 D^{Nasdaq}_{i,t} + 0.092\, Trsize_{i,t} - 0.084\, \mathrm{Log}(mcap_{i,t}) + 13.807 \left(\frac{1}{P_{i,t}} \right) \Bigg]. \tag{4}$$

$D^{Nasdaq}_{i,t}$ is a dummy variable that equals one if the trade occurs on Nasdaq and zero otherwise, $Trsize_{i,t}$ is the ratio of the dollar value of the purchase to the market capitalization of the stock, $\mathrm{Log}(mcap_{i,t})$ is the natural log of the market capitalization of the stock (expressed in \$thousands), and $P_{i,t}$ is the stock price at the time of the trade. Finally, Y^k_t is the year t trading cost factor for market k (k = NYSE/AMEX or Nasdaq). This factor captures the year-to-year changes in average trading costs over our time period in the different markets—these factors are based on Stoll (1995). Similarly, our equation for estimating the percentage cost of selling stock i during quarter t, $C^S_{i,t}$, is

$$C^S_{i,t} = Y^k_t \cdot \Bigg[0.979 + 0.058 D^{Nasdaq}_{i,t} + 0.214\, Trsize_{i,t} - 0.059\, \mathrm{Log}(mcap_{i,t}) + 6.537 \left(\frac{1}{P_{i,t}} \right) \Bigg]. \tag{5}$$

Further details on the development of these equations are given in Appendix B.

E. The Carhart Measure

Carhart (1997) develops a four-factor regression method for estimating mutual fund performance. This four-factor model is based on an extension of the Fama and French (1993) factor model and is described as

$$R_{j,t} - R_{F,t} = \alpha_j + b_j \cdot RMRF_t + s_j \cdot SMB_t + h_j \cdot HML_t + p_j \cdot PR1YR_t + e_{j,t}. \tag{6}$$

Here, $R_{j,t} - R_{F,t}$ equals the excess net return of fund j during month t (the fund net return minus T-bills); $RMRF_t$ equals the month t excess return on a value-weighted aggregate market proxy portfolio; and SMB_t, HML_t, and $PR1YR_t$ equal the month t returns on value-weighted, zero-investment factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns. We use the Carhart (1997) regression measure of performance, α, to estimate the characteristic-adjusted net returns of mutual funds from their net return time-series data. Also, in some instances, we compare the Carhart α, estimated for the gross return time series of mutual fund stock portfolios, to the *CS* measure described above. In this case, $R_{j,t}$ equals the gross return of fund j during month t, estimated from the periodic stock holdings data for the fund.

III. Results

A. Overall Mutual Fund Returns

We begin by providing an overall view of the performance of the mutual fund industry over the 1975 to 1994 time period. Table II compares several measures of mutual fund returns to the returns on two market indexes during the period: the S&P 500 index and the CRSP NYSE/AMEX/Nasdaq portfolio (both value weighted, with dividends reinvested). The measures of fund returns include the estimated returns on the stock portfolios of the funds (labeled "Gross Returns") and the realized net returns of funds.[16] The table presents each return measure, averaged both by the total net assets (TNA) of funds and by using an equal weighting (EW) across all funds. To compute the returns for a given year, we first compute the quarterly buy-and-hold return for the portfolio of all funds existing during the first quarter of that year, regardless of whether those funds survived past that quarter. Weights (TNA or EW) are rebalanced at the end of the first quarter, and the process is repeated for the second quarter (the third and fourth quarters are computed similarly). Finally, the annual return is computed by compounding these quarterly rebalanced, buy-and-hold returns. This procedure minimizes any survival bias, because it includes all funds existing during any given quarter.

The results show that the average mutual fund held stocks that significantly outperformed both market indexes over the 20-year period. First, the TNA-average gross return on stock holdings averaged 16.9 percent per year over the 20 years, compared to 15.4 and 15.6 percent per year for the S&P 500 and the CRSP indexes, respectively. Indeed, this TNA-average gross

[16] In estimating the return on the stock portfolio held by a fund during a given quarter, we compute the buy-and-hold return on the stock holdings reported in the most recent portfolio "snapshot" from the merged database for that fund, on or before the beginning of that quarter (using stock returns from the CRSP NYSE/AMEX/Nasdaq stock file to compute buy-and-hold stock returns). In most cases, this snapshot is available at the beginning of the calendar quarter, but, in some cases, the holdings are from an earlier date. A complete description of the limitations of the holdings data is available in Wermers (1999). Also, in computing the return on stock holdings, we normalize portfolio weights so that the weights of stocks held by a given fund add up to one.

Table II

Mutual Fund Returns

Mutual fund returns are provided below for the merged CDA holdings and CRSP mutual fund characteristics/net returns databases. This table provides, each year, the S&P 500 and CRSP NYSE/AMEX/Nasdaq returns, both value weighted with dividends reinvested. Also, both gross returns (on stock holdings only) and net reported mutual fund returns are provided for the mutual fund universe for each year, each weighted both by the total net assets (TNA) and by using an equal weighting (EW) across all mutual funds (weights are updated at the beginning of each quarter). Every fund existing during a given quarter (and having a complete data record) is included in the computation of that quarter's return measures, even if the fund does not survive past the end of that quarter. These quarterly buy-and-hold returns are compounded to give the quarterly rebalanced annual returns reported below. In all statistics in this table, we limit our analysis to funds having a self-declared investment objective of "aggressive growth," "growth," "growth and income," "income," or "balanced" at the beginning of a given calendar quarter. Note, also, that self-declared investment-objective data are available from CDA starting June 30, 1980, so the 1980 figures are as of that date. Before 1980, funds are classified by their investment objectives as of January 1, 1975 (these data were hand-collected from printed sources).

			Merged Database				
Year	S&P 500 Return	CRSP VW Return	No.	TNA-Avg Gross Returns (%/year)	EW-Avg Gross Return (%/year)	TNA-Avg Net Return (%/year)	EW-Avg Net Return (%/year)
1975	37.2	37.4	241	38.1	40.1	30.9	31.5
1976	23.8	26.8	241	26.7	28.0	23.0	23.6
1977	−7.2	−3.0	226	−3.0	0.2	−2.5	−0.1
1978	6.6	8.5	222	11.3	12.9	9.0	10.0
1979	18.4	24.4	219	27.9	32.9	23.7	26.2
1980	32.4	33.2	364	37.8	40.1	31.3	31.2
1981	−4.9	−4.0	365	−4.2	−2.3	−2.7	−0.6
1982	21.4	20.4	362	24.0	25.6	24.1	24.9
1983	22.5	22.7	347	23.6	23.9	20.4	20.1
1984	6.3	3.3	372	0.3	−0.6	−0.1	−0.8
1985	32.2	31.5	391	32.0	32.4	27.8	27.7
1986	18.5	15.6	418	17.7	15.8	15.8	14.1
1987	5.2	1.8	483	3.4	2.1	2.4	1.1
1988	16.8	17.6	543	18.7	18.2	15.9	14.5
1989	31.5	28.4	589	29.4	29.2	25.3	24.6
1990	−3.2	−6.0	637	−7.4	−7.4	−5.3	−5.5
1991	30.5	33.6	679	37.5	41.0	32.8	35.2
1992	7.7	9.0	815	9.1	10.0	8.2	9.1
1993	10.0	11.5	949	15.2	13.9	14.2	13.3
1994	1.3	−0.6	1,279	−0.4	−0.8	−1.6	−1.7
1975–1979	15.8	18.8	241	20.2	22.8	16.8	18.2
1980–1984	15.5	15.1	459	16.3	17.3	14.6	15.0
1985–1989	20.8	19.0	676	20.2	19.5	17.4	16.4
1990–1994	9.3	9.5	1,567	10.8	11.3	9.7	10.1
1975–1994	15.4	15.6	1,788	16.9	17.7	14.6	14.9

return beat the indexes during the majority of the years in our study. These return results, although not benchmark adjusted, are consistent with studies that indicate that mutual funds generally perform well in their choice of stocks.[17] The results for EW-average gross returns are even more promising—here, the average mutual fund holds stocks that outperform the market indexes by over two percent per year.

It is also informative to examine the net returns of the mutual fund industry. For example, a current issue of contention is whether mutual fund expenses and trading costs are excessive, given the level of performance of the funds. Table II shows that a significant gap indeed exists between the TNA-average net return and the TNA-average gross stock returns of funds over the 20 years. Specifically, gross returns average 16.9 percent per year, whereas net returns average 14.6 percent per year. However, the yearly differences between these two return measures indicate that the gross return tends to be substantially higher than the net return during years that the stock indexes perform well (which are generally years with a high equity premium over T-bills). For example, in 1975, a very high return year for stocks, the TNA-average gross return is 38.1 percent, versus 30.9 percent for the TNA-average net return. In contrast, the net return of the funds is actually higher than the stock portfolio return during 1977, a very poor return year for stocks. This indicates that the fund holdings of cash and bonds (presumably as a cushion to handle investor inflows and redemptions), which generally performed poorly over this time period (relative to stocks), contribute significantly to the reduced performance of funds on a net return basis.

In unreported tests, we examined seasonal differences between gross and net returns. Consistent with the yearly variation, seasonal differences were substantially larger during calendar months having the largest equity premia over the 1975 to 1994 period (for example, January and December).

Overall, Table II illustrates the differences between studies that examine the stock holdings of mutual funds and studies that examine the net returns. Specifically, the stock holdings of the mutual fund industry substantially outperform market indexes, yet the net returns significantly underperform the same indexes. The difference between the return on stock holdings and the net return of the funds is 2.3 percent per year, averaged by the total net assets of funds. In a later section of this paper, we will trace the contribution of expenses and transactions costs to this difference between gross and net returns. First, in the next section, we benchmark-adjust both the gross returns on stock holdings and the net returns to allow a comparison of these measures on a characteristic-adjusted basis.

B. Benchmark-Adjusted Mutual Fund Returns

Mutual funds tend to hold portfolios of stocks with distinct characteristics. Specifically, Grinblatt, Titman, and Wermers (1995) document that the majority of funds buy high past return stocks, and Chen et al. (2000) show that

[17] Note, also, that mutual fund returns track the CRSP VW index more closely than the S&P 500 index, due to the small stock holdings of funds.

funds also prefer growth stocks and large-capitalization stocks. Because these characteristics have been shown to be related to average returns during our sample period, the performance of mutual fund stock holdings relative to market indexes may be partly due to the characteristics of the stock holdings. As shown by Fama and French (1992, 1996), Jegadeesh and Titman (1993), Chan, Jegadeesh, and Lakonishok (1996), and Daniel and Titman (1997), the size (market capitalization of equity), the ratio of the book value of equity to the market value of equity, and the momentum (prior-year return) of stocks are powerful ex ante predictors of cross-sectional patterns in common stock returns. In this section, we benchmark-adjust the returns of mutual funds to determine the extent to which mutual fund managers choose stocks that outperform stocks having the same characteristics.

Table III presents yearly average mutual fund Characteristic-Selectivity measures (*CS* measures), weighted by the total net assets (TNA) of each fund. In computing the *CS* measure for a given year, we first compute TNA-average *CS* measures for each quarter of that year, across all funds existing during the quarter. For example, the average *CS* measure for the first quarter of 1975 is computed across all funds existing during that quarter, regardless of whether they survive past the end of the quarter. Similar computations are done for the second, third, and fourth quarters of 1975, and these quarterly TNA-average *CS* measures are then compounded into a quarterly rebalanced annual measure. Also presented are equal-weighted (EW) average *CS* measures—these return averages are computed in a manner similar to that of the TNA-average *CS* measures, but equal weights are applied across mutual funds at the beginning of each quarter. The average *CS* measure shown in Table III (Panel A) over the entire 1975 to 1994 period, and the averages shown over five-year subperiods (Panel B), are the simple time-series averages of the corresponding yearly returns.

The results in Panel A show that the mutual fund industry picks stocks that, on average, outperform their characteristic-matched benchmark portfolios. The TNA-average *CS* measure for the mutual fund universe is 71 basis points per year during the 20-year period—although the funds do not hold stocks that outperform their benchmarks during all years of our sample period, they manage to outperform their benchmarks during the majority of the years. The EW-average *CS* measure is 101 basis points per year, indicating that small funds have better stock-picking talents than large funds during our sample period.[18] Panel B shows that the average *CS* measure is higher during 1975 to 1979 than during the following three five-year subperiods, both for the TNA-average and for the EW-average portfolios. However, the average measure is positive during all subperiods for both averaging methods.

[18] However, part of the drag on the performance of larger funds may be due to the lower portfolio turnover rates of these funds. These lower turnover rates are, in turn, likely due to an avoidance of incurring the larger transactions costs they face, relative to small funds, because of the large scale of their investments.

In unreported tests, we examined seasonal average *CS* measures. The *CS* measure, averaged across all Decembers from 1975 to 1994, was unusually high (3.56 percent, annualized), but the average May and November were also large (1.60 and 1.68 percent, annualized, respectively). In addition, an *F*-test could not reject the equality of the monthly *CS* measures (the two-tailed *p*-value was 29 percent). Thus, December is an anomaly, but it is not the only month with a large and significant *CS* measure.

In the last section, we found that the TNA-average portfolio of funds outperforms the CRSP value-weighted index by an average of 130 basis points per year. Here, we find a TNA-average *CS* measure of 71 basis points per year, which represents the return on the stock holdings of mutual funds in excess of the return on their characteristic-matched benchmark portfolios. Based on these results, the remaining 59 basis points per year must be attributable to returns related to the characteristics of stock holdings, either through the ability of funds to time the characteristics (Characteristic Timing, *CT*) or through the long-term holdings of stocks having characteristics with higher average returns (Average Style, *AS*). We will explore these two sources of performance in a later section of this paper.

Panel B of Table III compares the average *CS* measure of mutual fund stock holdings to the average Carhart net return performance measure ($\alpha^{Net}_{Carhart}$) of the funds. To compute the Carhart measure for a given period, we regress the monthly time series of cross-sectional average excess net returns (either TNA- or EW-averaged across funds) on the monthly time series of returns for the four Carhart factor-mimicking portfolios; the intercept from this regression is the Carhart performance measure for the fund universe. In forming average monthly excess net returns, we include all funds existing during a given month. Panel B reports the resulting Carhart measures (annualized to percentage per year).

The Carhart measures vary somewhat across different subperiods; however, the measures are negative in all cases. This finding is consistent with the generally negative net return performance measures reported in Carhart (1997) and elsewhere. Specifically, the TNA-average and the EW-average Carhart measures over the 1975 to 1994 period are −1.16 and −1.15 percent per year, respectively. Both measures are statistically significant at the 1 percent level. In unreported tests, we found that the Vanguard Index 500 fund has a Carhart net return measure of −29 basis points per year. Thus, the TNA-average mutual fund underperforms the Vanguard fund by 87 basis points per year, adjusted for the characteristics of stock holdings. We will analyze the Vanguard fund in more detail in a later section of this paper.

Overall, we find that the TNA-average *CS* performance measure, at the stock holdings level, is 71 basis points per year, whereas the TNA-average Carhart measure, at the net return level, is −116 basis points per year. This difference between the TNA-average characteristic-adjusted returns of fund stock holdings and fund net returns (which also include the return contribution of nonstock holdings of funds)—roughly 1.9 percent per year—

Table III

Mutual Fund Characteristic-Adjusted Performance

Average performance measures for the stock holdings portion of mutual fund portfolios are presented in Panel A of this table for the merged CDA holdings and CRSP mutual fund characteristics/net returns databases. To compute the characteristic-adjusted return for a given stock during a given quarter, the buy-and-hold return on a value-weighted portfolio of stocks having the same size, book value to market value of equity, and prior-year return characteristics as the stock is subtracted from that stock's buy-and-hold return during the quarter. Each mutual fund's *CS* measure, for a given quarter, is then computed as the portfolio-weighted characteristic-adjusted return of the individual stocks in the fund's portfolio (normalizing so that the weights of all stocks add to one). Then, the average *CS* measure is computed across the mutual fund universe each quarter, weighted both by the total net assets (TNA) and by using an equal-weighting (EW) across all mutual funds (weights are updated at the beginning of each quarter). Every fund existing during a given quarter (and having a complete data record) is included in the computation of that quarter's average *CS* measure, regardless of whether the fund survived past the end of that quarter. These quarterly buy-and-hold *CS* measures are compounded to give the quarterly rebalanced annual *CS* measures reported below. Also presented in Panel A are the number of funds existing at the beginning of each listed year (except as noted in this legend). Panel B compares the *CS* measures with the intercept from a Carhart four-factor time-series regression of monthly fund excess net returns (TNA average and EW average across funds) on the monthly excess return associated with a value-weighted aggregate market proxy portfolio; and monthly returns on value-weighted, zero-investment factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns. Panel B also includes, in the computation of the measures each quarter, all funds existing during that quarter—the count of funds reflects all mutual funds that existed for at least one quarter during each subperiod. In all measures in both panels of this table, we limit our analysis to funds having a self-declared investment objective of "aggressive growth," "growth," "growth and income," "income," or "balanced" at the beginning of a given calendar quarter. Note, also, that self-declared investment-objective data are available from CDA starting June 30, 1980, so the 1980 figures are as of that date. Before 1980, funds are classified by their investment objectives as of January 1, 1975 (these data were hand-collected from printed sources).

Panel A. Performance of Mutual Fund Stock Portfolios

	Merged Database		
Year	Number	TNA-Avg *CS* Measure (%/year)	EW-Avg *CS* Measure (%/year)
1975	241	0.002	0.73
1976	241	0.23	−0.31
1977	226	0.34	1.28
1978	222	3.46	3.64
1979	219	1.79	2.79
1980	364	0.83	1.59
1981	365	0.21	0.87
1982	362	2.53	2.79
1983	347	1.12	1.03
1984	372	−1.15	−1.27
1985	391	−0.07	0.31
1986	418	0.40	0.45
1987	483	1.54	2.10
1988	543	0.20	−0.57

Table III—*Continued*

Panel A. Performance of Mutual Fund Stock Portfolios (*continued*)

	Merged Database		
Year	Number	TNA-Avg *CS* Measure (%/year)	EW-Avg *CS* Measure (%/year)
1989	589	−0.26	0.65
1990	637	−0.69	0.97
1991	679	1.95	1.74
1992	815	0.07	0.13
1993	949	1.70	1.02
1994	1,279	0.03	0.23
1975–1994†	1,788	0.71**	1.01***
		(2.79)	(3.76)

Panel B. Performance of Fund Stock Portfolios versus Net Fund Performance†

		Merged Database			
Period	Number	TNA-Avg *CS* Measure (%/year)	EW-Avg *CS* Measure (%/year)	TNA-Avg $\alpha^{Net}_{Carhart}$ (%/year)	EW-Avg $\alpha^{Net}_{Carhart}$ (%/year)
1975–1979	241	1.17	1.62*	−0.81	−0.77
		(1.78)	(2.28)	(−1.04)	(−0.91)
1980–1984	459	0.71	1.00	−1.33	−1.14
		(1.18)	(1.51)	(−1.35)	(−1.12)
1985–1989	676	0.36	0.59	−0.73	−1.07**
		(1.15)	(1.35)	(−1.21)	(−2.01)
1990–1994	1,567	0.61	0.82**	−0.71	−0.47
		(1.19)	(2.77)	(−1.32)	(−0.98)
1975–1994	1,788	0.71**	1.01***	−1.16***	−1.15***
		(2.79)	(3.76)	(−2.96)	(−2.93)

†Time-series *t*-statistics are in parentheses.
*Significant at the 90% confidence level.
**Significant at the 95% confidence level.
***Significant at the 99% confidence level.

can be compared to the difference between the unadjusted returns of fund stock holdings and net returns (presented in the last section)–2.3 percent per year. Thus, about 40 basis points per year of the 2.3 percent per year difference between gross and net returns can be explained by the lower average returns and risk of bonds and cash relative to stocks during this period. In a later section of this paper, we use a cost-based approach (by deducting, from the 2.3 percent per year, 1.6 percent per year for expenses and transactions costs) to arrive at an estimate of 70 basis points per year being due to the lower average returns of nonstock holdings. Note that these

estimates (40 to 70 basis points per year) are roughly consistent with the equity premium over the 1975 to 1994 period (large company stocks minus T-bills), which averaged 7.5 percent per year—mutual funds held 10 to 15 percent T-bills and bonds in their portfolios over the period.

In the remainder of this paper, we weight each mutual fund measure by the total net assets under management of the fund. Although, in this section, we have found stronger evidence of stock-picking talent when looking at the average mutual fund, we wish to compute measures of return and performance for the average dollar invested in the mutual fund industry.

C. The Correlation between Performance Measures

Our results of the last section show strong evidence that, on average, mutual funds pick stocks that outperform their characteristic benchmarks. In addition, net of all expenses and transactions costs, mutual funds underperform their Carhart benchmark portfolios, on average. However, an interesting issue is the correlation, across funds, of performance at the stock holdings level and performance at the net returns level. Although, at first blush, it would seem that the correlation would be near unity, the issue becomes more interesting if the expenses and transactions costs of funds are also positively correlated with their preexpense performance. The tendency of funds with superior stock-picking skills to incur higher costs would be consistent with the equilibrium model of Grossman and Stiglitz (1980), where the expected returns to information gathering and processing skills are equal to the costs.

Table IV investigates this issue by presenting cross-sectional correlations (across funds) between various measures of performance. These performance measures are computed over the entire life of each mutual fund during our sample period. The only restriction we place on a fund to be included in these correlations is that the fund must have at least 24 valid monthly return observations (both for stock holdings and net returns) to provide reasonable degrees of freedom in the regression-based measures.

Panel A of that table presents Pearson correlations between three measures of performance at the stock portfolio level: the Characteristic-Selectivity measure (CS), the Carhart measure using the time series of excess monthly returns on the stock portfolio as the explained variable ($\alpha^{Gross}_{Carhart}$) and the Jensen measure using the same explained variable (α^{Gross}_{Jensen}). In addition, two measures of performance at the net return level are included: the Carhart measure using the time series of excess monthly net returns as the explained variable ($\alpha^{Net}_{Carhart}$) and the Jensen measure using the same explained variable (α^{Net}_{Jensen}). Panel B presents Spearman rank correlations between all of these performance measures.

Several observations may be drawn from the two correlation matrices. First, the cross-sectional Pearson correlation (at the gross return level) between the Jensen and Carhart measures is 0.74, which indicates that adding

Table IV

Mutual Fund Performance Measure Correlations

In this table, we present cross-sectional correlations (across funds) between different measures of mutual fund performance. The measures included in this table are the Characteristic Selectivity measure (*CS*), the Carhart four-factor regression alpha, and the Jensen regression alpha for the stock portfolio of each mutual fund (labeled "gross" alphas); and the Carhart four-factor regression alpha and the Jensen regression alpha for the realized net returns of the funds (labeled "net" alphas). To compute the characteristic-adjusted return for a given stock during a given quarter, the buy-and-hold return on a value-weighted portfolio of stocks having the same size, book value to market value of equity, and prior-year return characteristics as the stock is subtracted from that stock's buy-and-hold return during the quarter. Each mutual fund's *CS* measure, for a given quarter, is then computed as the portfolio-weighted characteristic-adjusted return of the individual stocks in the fund's portfolio (normalizing so that the weights of all stocks add to one). Finally, the average quarterly *CS* measure is computed for each fund, across all quarters that fund is in existence. To compute the four-factor Carhart gross alpha, the time series of monthly buy-and-hold excess returns for a given fund (the hypothetical stock returns, using CRSP stock return data applied to fund holdings data, minus the return on T-bills) are regressed on (1) the time series of monthly returns associated with a value-weighted market proxy portfolio minus T-bills, (2) the difference in monthly returns between small- and large-capitalization stocks, (3) the difference in monthly returns between high and low book-to-market stocks, and (4) the difference in monthly returns between stocks having high and low prior-year returns. To compute the Jensen gross alpha, a similar regression is computed on only the first regressor of the Carhart regression. The procedure for computing Carhart and Jensen net alphas is similar, except that the excess net return (net realized return from the CRSP database minus T-bills) is the dependent variable in the regressions. For all regressions, a minimum of 24 months of return observations must be available during the entire life of a given fund to be included—this table includes correlations between performance measures for only those funds having this minimum number of return observations. See Daniel et al. (1997), Fama and French (1993), and Carhart (1997) for further details on these procedures. Panel A provides Pearson correlation coefficients between these measures, across all funds, whereas Panel B provides Spearman rank-correlation coefficients between the measures. All two-tailed *p*-values in both panels are less than 0.0001.

Panel A. Pearson Correlations

$\rho_{Pearson}$	CS	$\alpha^{Gross}_{Carhart}$	$\alpha^{Net}_{Carhart}$	α^{Gross}_{Jensen}	α^{Net}_{Jensen}
CS	1	—	—	—	—
$\alpha^{Gross}_{Carhart}$	0.57	1	—	—	—
$\alpha^{Net}_{Carhart}$	0.36	0.62	1	—	—
α^{Gross}_{Jensen}	0.58	0.74	0.43	1	—
α^{Net}_{Jensen}	0.33	0.49	0.84	0.63	1

Panel B. Spearman Rank Correlations

$\rho_{Spearman}$	CS	$\alpha^{Gross}_{Carhart}$	$\alpha^{Net}_{Carhart}$	α^{Gross}_{Jensen}	α^{Net}_{Jensen}
CS	1	—	—	—	—
$\alpha^{Gross}_{Carhart}$	0.65	1	—	—	—
$\alpha^{Net}_{Carhart}$	0.46	0.63	1	—	—
α^{Gross}_{Jensen}	0.53	0.67	0.44	1	—
α^{Net}_{Jensen}	0.40	0.49	0.80	0.68	1

the size, book-to-market, and momentum factors provides only a slight increase in the precision of the performance estimate over using only the market factor. This result indicates that mutual fund loadings on these omitted variables in the Jensen regression are correlated with their intercept in the Carhart regression. The Spearman rank correlation between these two measures is similar, 0.67.

The correlations between the *CS* measure and the Carhart and Jensen gross performance measures are 0.57 and 0.58, respectively. This lower correlation supports the idea that the *CS* measure provides more precise adjustments for characteristic-based returns than the regression-based methods.[19] Again, Spearman rank correlations are similar.

At the net return level, the Carhart and Jensen performance measures are again highly correlated, both with the Pearson correlation and with the nonparametric Spearman rank correlation. A comparison of these measures at the gross stock holdings return level and the net return level provides further insight. For example, the Carhart measure of the stock holdings of funds is highly correlated with the Carhart net return performance measure. The Pearson correlation is 0.62, whereas the Spearman correlation is 0.63. These high correlations between gross and net performance indicate that the level of mutual fund expenses and transactions costs, although possibly correlated with fund performance at the stock holdings level, do not eliminate the higher benchmark-adjusted net returns provided by funds with stock-picking talents.[20]

D. Baseline Mutual Fund Return Decomposition

In this section, we decompose the returns of mutual funds to further analyze the value of active stock-picking strategies. Panel A of Table V provides several different yearly measures for the mutual fund universe, averaged by the total net assets of funds. As discussed in Section III.A, the mutual fund universe held stocks during our sample period with average returns of 16.9 percent per year, using a TNA weighting across funds. This average return level beats the CRSP value-weighted index by 130 basis points per year. In Section III.B, we showed that the stock-picking talents of fund managers could explain 71 basis points per year of this return difference. However, do these fund managers have the ability to time characteristics–for example, do they buy momentum stocks just before a high momentum return premium? Panel A addresses this question by presenting yearly

[19] See Daniel et al. (1997) for evidence that further supports the use of the *CS* measure versus the Carhart and Jensen alphas. The *CS* performance estimates are roughly the same magnitude as the Carhart and Jensen alphas, but the estimated *CS* standard errors are much lower.

[20] In a later section of this paper, we will analyze this issue more closely by examining the performance of high-turnover funds, both at the stock holdings and the net returns level. In addition, we will determine the level of expenses and transactions costs for these high-turnover funds, which will allow us to determine whether the higher returns provided by their frequent trades result in higher net returns to investors.

average returns associated with characteristic selectivity abilities (*CS*), characteristic timing abilities (*CT*), and the average returns to the characteristics of mutual fund stock holdings (*AS*).

In Table V, we present averages over the 1976 to 1994 period, because the *CT* and *AS* measures require one-year lagged portfolio weights. The corresponding average return of the CRSP value-weighted index is 14.5 percent per year. Over this period, funds hold stocks with gross returns of 15.8 percent per year—again, 130 basis points per year higher than the CRSP index. Panel A shows that 75 basis points per year can be attributed to the stock-selection talents (the *CS* measure) of fund managers. The table also shows that funds exhibit no abilities in timing the characteristics—these *CT* measures are very close to zero during each five-year subperiod and over the entire 20-year period. Thus, the remaining 55 basis point difference (per year) between gross fund returns and the CRSP index can be attributed to the higher average returns earned by the characteristics of the stock holdings of mutual funds, relative to the CRSP index.[21] Specifically, Chen et al. (2000) show that mutual funds exhibit a preference for holding small stocks, growth stocks, and momentum stocks, as compared to the market portfolio. Although growth stocks, with a negative loading on the book-to-market factor, earn lower average returns, small stocks and momentum stocks earn higher average returns. The overall result is that funds hold stocks with characteristics that outperformed the market portfolio during the 20-year period of our sample.

The panel also shows the general trend of expense ratios, transactions costs, and portfolio turnover levels over the period. Expense ratios have increased substantially, rising from 65 basis points per year in 1975 to 99 basis points in 1994. The tendency of funds to substitute 12b-1 fees for load fees accounts for a portion of this increase. However, the higher proportion of small funds in the sample during later years accounts for the bulk of this increase—as noted by Rea and Reid (1998), expense ratios for the 100 largest U.S. equity mutual funds existing in 1997, and established before 1980, have fallen modestly.

An examination of transactions costs and turnover levels also adds insight. Although the trading activity of the average mutual fund has more than doubled over the 20-year period, estimated transactions costs have decreased substantially. Specifically, the average mutual fund exhibited a yearly turnover level of 35.2 percent during the 1976 to 1979 subperiod, increasing to 70.2 percent during the 1990 to 1994 subperiod. However, although 104 basis points of the total net assets of funds was expended each year on trading costs (including commissions and the market impact of trades) during

[21] Although the *AS* measure exceeds the CRSP VW index by only 30 basis points per year over the 1976 to 1994 period (14.8 vs. 14.5 percent per year), we note that stocks that are omitted from the computation of the *AS* measure are those with missing COMPUSTAT or CRSP data. These stocks are generally small stocks; therefore, we infer that they would mainly add to the *AS* measure, if included.

Table V

Baseline Mutual Fund Return Decomposition

A decomposition of mutual fund returns and costs is provided below for the merged CDA holdings and CRSP mutual fund characteristics/net returns databases. Panel A of this table provides, each year, the number of mutual funds (at the beginning of the year, except as described in this legend) in the merged mutual fund database. In addition, the panel shows, weighted by the total net assets (TNA) of mutual funds (updated at the beginning of each quarter), the following average annual statistics: return on the stock portfolio of the funds (Gross Return), characteristic selectivity measure (CS), characteristic timing measure (CT), average style measure (AS), expense ratio, estimated transactions costs, net reported return, and portfolio turnover ratio. Every fund existing during a given calendar quarter (and having a complete data record) is included in the computation of that quarter's return measures, even if the fund does not survive past the end of that quarter. These quarterly buy-and-hold returns are compounded to give the quarterly rebalanced annual returns reported below. In all measures in this table, we limit our analysis to funds having a self-declared investment objective of "aggressive growth," "growth," "growth and income," "income," or "balanced" at the beginning of a given quarter (for return and transaction-cost measures) or year (for expense ratio and turnover measures). Note, also, that self-declared investment-objective data are available from CDA starting June 30, 1980, so the 1980 figures are as of that date. Before 1980, funds are classified by their investment objectives as of January 1, 1975 (these data were hand-collected from printed sources). Panel B presents several comparable measures for the Vanguard Index 500 fund. Time-series inference tests are presented, where appropriate.

Panel A. Mutual Fund Universe (TNA-Averaged)

	Merged Database								
Year	Number	Gross Return (%/year)	*CS* (%/year)	*CT** (%/year)	*AS** (%/year)	Expense Ratio (%/year)	Transactions Costs (%/year)	Net Return (%/year)	Turnover (%/year)
1975	241	38.1	0.002	—	—	0.65	1.40	30.9	32.7
1976	241	26.7	0.23	1.15	25.2	0.64	1.32	23.0	32.6
1977	226	−3.0	0.34	0.52	−4.5	0.65	0.68	−2.5	29.3
1978	222	11.3	3.46	0.61	7.3	0.68	0.94	9.0	39.6
1979	219	27.9	1.79	−1.24	25.7	0.69	0.84	23.7	39.1
1980	364	37.8	0.83	0.13	35.2	0.70	0.96	31.3	53.6
1981	365	−4.2	0.21	−0.52	−4.1	0.70	0.91	−2.7	51.9
1982	362	24.0	2.53	1.83	19.1	0.74	1.23	24.1	60.7
1983	347	23.6	1.12	0.72	22.1	0.73	0.91	20.4	64.8
1984	372	0.3	−1.15	−0.63	2.6	0.80	1.02	−0.1	64.1
1985	391	32.0	−0.07	0.23	32.0	0.77	0.88	27.8	74.7
1986	418	17.7	0.40	−0.96	17.7	0.76	0.72	15.8	75.3
1987	483	3.4	1.54	0.78	1.8	0.81	0.56	2.4	79.2
1988	543	18.7	0.20	−1.07	18.9	0.88	0.56	15.9	68.1
1989	589	29.4	−0.26	0.31	29.7	0.88	0.50	25.3	65.1
1990	637	−7.4	−0.69	0.64	−7.0	0.91	0.47	−5.3	69.6
1991	679	37.5	1.95	−0.93	36.4	0.87	0.48	32.8	68.7
1992	815	9.1	0.07	−1.13	10.8	0.94	0.48	8.2	67.8
1993	949	15.2	1.70	0.22	12.1	0.96	0.49	14.2	71.7
1994	1,279	−0.4	0.03	−0.34	0.001	0.99	0.48	−1.6	72.8
1976–1979	241	15.7	1.46	0.26	13.4	0.67	1.04	13.3	35.2
1980–1984	459	16.3	0.71	0.31	15.0	0.73	1.01	14.6	59.0
1985–1989	676	20.2	0.36	−0.14	20.0	0.82	0.64	17.4	72.5
1990–1994	1,567	10.8	0.61	−0.31	10.5	0.93	0.48	9.7	70.2
1976–1994	1,788	15.8	0.75**	0.02	14.8	0.79	0.80	13.8	60.5

continued

Table V—*Continued*

Panel B. Vanguard Index 500 Fund

Year	S&P 500 Return (%/year)	Vanguard				
		Gross Return[T] (%/year)	Expense Ratio (%/year)	Transactions Costs[T] (%/year)	Net Return (%/year)	Turnover (%/year)
1975	37.2	—	—	—	—	—
1976	23.8	—	—	—	—	—
1977	−7.2	—	0.46	—	−7.8	—
1978	6.6	—	0.36	—	5.9	8
1979	18.4	—	0.30	—	18.1	29
1980	32.4	—	0.35	—	31.7	18
1981	−4.9	−4.5	0.42	0.07	−5.1	12
1982	21.4	22.1	0.39	0.12	21.0	11
1983	22.5	23.2	0.28	0.14	21.4	39
1984	6.3	7.1	0.27	0.09	6.3	14
1985	32.2	32.2	0.28	0.11	31.4	36
1986	18.5	18.5	0.28	0.05	18.1	29
1987	5.2	6.1	0.26	0.06	4.7	15
1988	16.8	16.6	0.22	0.05	16.2	10
1989	31.5	31.4	0.22	0.06	31.4	8
1990	−3.2	−3.6	0.22	0.05	−3.3	23
1991	30.5	30.3	0.20	0.05	30.2	5
1992	7.7	7.3	0.19	0.03	7.4	4
1993	10.0	10.0	0.19	0.02	9.9	6
1994	1.3	1.5	0.19	0.02	1.2	6
1977–1979	5.9	—	0.37	—	5.4	18.5†
1980–1984	15.5	12.0†	0.34	0.11†	15.1	18.8
1985–1989	20.8	21.0	0.25	0.07	20.4	19.6
1990–1994	9.3	9.1	0.20	0.03	9.1	8.8
1977–1994	13.7	14.2†	0.28	0.07†	13.3	16.1

*The *CT* and *AS* measures begin in 1976, because both measures require one-year lagged portfolio weights.
[T]Vanguard Index 500 fund holdings data are available starting in 1981.
†Averaged over all available years.
**Significant at the 95% confidence level.

the first subperiod, only 48 basis points was spent during the last subperiod. Even with substantially higher levels of trading, total transactions costs have roughly been halved from the first to the last five-year subperiod. Certainly, the substantial decrease in transactions costs in the various markets contributed significantly to this trend; however, it is also likely that funds are able to execute trades more carefully with the increased level of technology in use in mutual fund complexes.

Panel A of Table V also shows the general trend of net mutual fund returns. As noted in a previous section, trends in net returns generally follow those in gross stock holdings returns, although larger differences between the two return measures occur during subperiods with a higher equity premium (large company stocks minus T-bills). Of course, changes in transactions costs and expense ratios also impact the difference between gross and net returns over the sample period. However, the general increase in average expense ratios, and the decrease in average transactions costs, have resulted in the sum of these two costs remaining relatively constant over the years.

Finally, a cost-based accounting for the difference between gross and net returns adds further insight. Section III.A documented a 230 basis point per year difference between TNA-averaged gross and net returns over the 1975 to 1994 period. Panel A shows that expense ratios and transactions costs each account for roughly 80 basis points per year of this difference. Thus, the remaining 70 basis points per year can be attributed to the lower average returns accruing to nonstock holdings, relative to stocks.

E. A Comparison of the Average Mutual Fund to the Vanguard Index 500 Fund

An often quoted claim by John Bogle, senior chairman of the Vanguard fund family, is that the Vanguard Index 500 fund outperforms the average mutual fund due to the low costs and low trading activity of the fund (see, e.g., Bogle (1994)). The implication of these claims is that money managers who actively chase stocks do not have the ability to find stocks that outperform the market portfolio by enough to recover their expenses and trading costs. This marketing appeal has been hugely successful—as of November 1999, the Vanguard fund manages $97 billion in assets, placing it within the largest two mutual funds in the United States.

In Panel B, we examine the returns to the Vanguard Index 500 fund to determine the validity of these claims. Specifically, Panel B decomposes the Vanguard fund returns into several components and provides the turnover level of the fund during various years. Not surprisingly, the gross returns on stock holdings for the Vanguard fund track the S&P 500 index very closely. Interesting, however, is the general decrease in expenses charged by the fund, as Vanguard increasingly attempts to compete for investment dollars through a low-cost approach. Specifically, the fund expense ratio decreased from 46 basis points during 1977 to 19 basis points during 1994.

However, this is likely a best-case scenario for index fund expenses, because the average index fund charges an expense ratio in the neighborhood of 30 to 40 basis points per year. Noteworthy is that recent low-cost competitive pressures by S&P Depositary Receipts (Spiders) have forced Vanguard and some other index funds to waive a portion of their normal fees.

The panel also shows that transactions costs incurred by the fund as it responds to fund inflows and outflows (and to changes in the composition of the S&P 500 index) are extremely low. These estimated costs are, in general, below 10 basis points per year. This low-cost item provides a large advantage for the Vanguard fund over actively managed funds.

Our previous analysis showed that, over 1975 to 1994, the TNA-average mutual fund holds stocks that outperform the S&P 500 index by 150 basis points per year. We also showed that 71 basis points of this difference is due to the stock-picking talents of funds, whereas the remainder is due to the higher average returns associated with the characteristics of the fund stock holdings, relative to the S&P 500 index. However, to determine whether the claim of Vanguard is valid, we must compare net returns between the TNA-average mutual fund and the Vanguard fund.

Because net returns are available in the merged database for the Vanguard fund beginning in 1977, we compare the Vanguard fund to the average mutual fund during the 1977 to 1994 period. Over this time period, the Vanguard fund provided an average net return to investors of 13.3 percent per year. By comparison, the TNA-average mutual fund also returned an average of 13.3 percent per year to investors during the 1977 to 1994 period. As noted in Section III.B, however, the TNA-average and EW-average characteristic-adjusted net returns (Carhart measures) over the 1975 to 1994 period are -1.16 and -1.15 percent per year, respectively. In unreported tests, we found that the Vanguard Index 500 fund has a Carhart net return measure of -29 basis points per year.

Thus, we conclude that the claims of the Vanguard fund management are not overwhelmingly supported by the unadjusted net returns. Our evidence indicates that the average mutual fund holds stocks with returns that compensate for the higher expenses and trading costs, relative to the Vanguard Index 500 fund. However, if one views the return boost from the characteristics of stock holdings of mutual funds as wholly a compensation for risk, then the funds underperform the Vanguard Index 500 fund by 87 basis points per year.

F. Do Funds that Trade More Frequently Generate Better Performance?

A concept that is central to the idea of actively managed funds outperforming index funds is that higher levels of trading activity are associated with better stock-picking abilities. Do higher levels of mutual fund trading result in higher levels of performance? Our next tests address this issue by examining the performance of high- versus low-turnover funds. If more frequent trading is associated with managers having better stock-picking talents, then we should observe a corresponding increase in performance, at

least before trading costs and expenses are factored in. If, instead, managers trade more frequently in an attempt to convince investors that they can successfully pick stocks, we should see no increase in performance before costs and expenses. In this case, we should actually see lower performance, *after* costs and expenses are deducted, for frequent traders. Carhart (1997) finds evidence that supports this view, although his data set does not allow an examination of performance at the stock holdings level.

We proceed as follows. At the end of each year, beginning on December 31, 1975, and ending December 31, 1993, we rank all mutual funds (with at least a one-year history) on their turnover level of the prior year (the "ranking year"). Fractile portfolios are formed based on this ranking, and TNA-average fund returns and characteristics are computed over the following year (the "test year"). In computing the test year average returns or performance measures, we first compute TNA-average measures for each quarter of the test year, across all funds that existed during that quarter (whether or not they survived past the end of the quarter) to minimize survival bias. Then, these quarterly TNA-weighted buy-and-hold returns are compounded into a quarterly rebalanced test-year return.

Table VI shows the results of this test, averaged over all test years. Several observations are apparent from these results. First, the highest turnover fund decile has a TNA-average turnover level of 155 percent per year, whereas the lowest decile has an average turnover level of only 14 percent per year. Thus, high-turnover funds trade roughly 10 times as frequently as low-turnover funds. The reader should note that the bottom decile (and perhaps quintile) is populated with several index funds, especially during the later years of our sample period.

Also, high-turnover funds hold stock portfolios that significantly outperform the portfolios of low-turnover funds—specifically, stock holdings of the top turnover decile outperform those of the bottom decile by 4.3 percent per year, on average. An examination of differences in the other measures provides insight into the attribution of this difference—2.2 percent per year is generated by high-turnover funds holding stocks with characteristics that provide higher returns than stocks held by low-turnover funds (the *AS* measure), whereas another 1.2 percent per year is due to significantly better stock-picking talents (the *CS* measure) of high-turnover funds. The remaining 90 basis points per year can be attributed to the slightly higher timing abilities (the *CT* measure) of high-turnover funds and to estimation error.[22]

High-turnover funds, however, incur much higher transactions costs than their low-turnover counterparts (a difference of 2.4 percent per year), in addition to charging somewhat higher expense ratios (a difference of 28

[22] Specifically, the *CS*, *CT*, and *AS* measures include only stocks that are listed in COMPUSTAT and have a one-year return history in CRSP, whereas the gross return computation includes all stocks having a current-quarter CRSP return. High-turnover funds tend to be smaller funds, which generally have larger holdings of small stocks—this results in a bigger shortfall of the sum of $CS + CT + AS$ as compared to the gross return among high-turnover funds (relative to low-turnover funds). The shortfall is due to the small stock premium that is reflected in the gross return, but not in the *AS* measure.

Table VI

Turnover-Sorted Mutual Fund Return Decomposition

A decomposition of mutual fund returns and costs is provided below for the merged CDA holdings and CRSP mutual fund characteristics/net returns databases. At the end of each year, starting December 31, 1975, and ending December 31, 1993, we rank all mutual funds in the merged database that existed during the entire prior year (and had a complete data record during that year) on their portfolio turnover level of that year (the "ranking year"). Then, fractile portfolios are formed, and we compute average return measures (e.g., net returns) for each fractile portfolio during the following year (the "test year"). In computing the average return measure for a given test year, we first compute quarterly buy-and-hold returns for each fund that exists during each quarter of the test year, regardless of whether the fund survives past the end of that quarter. Then, we compute the total net asset-weighted (TNA) average quarterly buy-and-hold return across all funds for each quarter of the test year. Finally, we compound these returns into an annual return that is rebalanced quarterly. Presented in this table are the following TNA-average annual statistics: return on the stock portfolio of the funds (Gross Return), characteristic selectivity measure (CS), characteristic timing measure (CT), average style measure (AS), expense ratio, estimated transactions costs, net reported return, Carhart net return alpha, and portfolio turnover ratio. The table presents test year statistics, averaged over all test years. The table also shows the time-series average number of funds within each fractile portfolio. In forming all portfolios in this table, we limit our analysis to funds having a self-declared investment objective of "aggressive growth," "growth," "growth and income," "income," or "balanced" at the beginning of the test year. Note, also, that self-declared investment-objective data are available from CDA starting June 30, 1980, so the 1980 figures are as of that date. Before 1980, funds are classified by their investment objectives as of January 1, 1975 (these data were hand-collected from printed sources). Time-series inference tests are presented, where appropriate.

Fractile	Avg No	Gross Return (%/year)	CS (%/year)	CT (%/year)	AS (%/year)	Expense Ratio (%/year)	Trans. Costs (%/year)	Net Return (%/year)	$\alpha^{Net}_{Carhart}$ (%/year)	Turnover (%/year)
Top 10%	42	19.5	1.46*	0.28	16.8	0.97	2.65	15.5	−1.00	155
Top 20%	84	19.1	1.83***	0.31	16.3	0.94	2.07	15.9	−0.68	132
2nd 20%	84	17.3	1.33***	0.53*	15.1	0.90	1.12	15.2	−0.98*	82
3rd 20%	84	16.2	0.89**	0.16	15.1	0.82	0.82	14.3	−1.24**	57
4th 20%	84	15.8	0.59	−0.07	15.0	0.70	0.92	13.7	−1.40***	33
Bottom 20%	84	14.8	0.02	−0.06	14.6	0.64	0.33	13.2	−1.01**	18
Bottom 10%	42	15.2	0.24	0.05	14.6	0.69	0.28	13.4	−0.85*	14
Top-Bottom 10%	42	4.3*	1.22	0.23	2.2***	0.28***	2.37***	2.1	−0.15	141***
Top-Bottom 20%	84	4.3**	1.81***	0.37	1.7**	0.30***	1.74***	2.7**	0.33	114***
All Funds	420	16.2	0.79**	0.11	15.0	0.77	0.88	14.2	−1.12***	59

*Significant at the 90% confidence level.
**Significant at the 95% confidence level.
***Significant at the 99% confidence level.

basis points per year). These factors reduce the net return advantage of high-turnover funds, although they still outperform low-turnover funds by 2.1 percent per year. Although this figure is not statistically significant, the net return difference between the top and bottom turnover quintiles, 2.7 percent per year, is significant at the 95 percent confidence level.

Finally, we benchmark-adjust the TNA-average net returns of each turnover fractile, using the Carhart measure (labeled $\alpha^{Net}_{Carhart}$). Here, there is no significant difference in results between high- and low-turnover funds. Indeed, the Carhart measure is actually lowest for the middle turnover quintiles, which may explain why Carhart (1997) found a negative relation between turnover and benchmark-adjusted net returns (the Carhart measure) and Chalmers, Edelen, and Kadlec (1999) found a negative relation between trading costs and benchmark-adjusted returns.

It is interesting to compare the TNA-average net return provided by high-turnover funds to that provided by the Vanguard Index 500 fund. The average unadjusted net returns of the top two turnover quintiles are 15.9 and 15.2 percent per year, respectively. The average net return of the Vanguard fund, assuming that it matches the S&P 500 return in 1976 (our first test year) is 13.8 percent per year; therefore, the top two quintiles of funds, ranked by their turnover level, clearly beat the Vanguard fund on a net return basis. However, only the top quintile of funds has a Carhart performance measure (-68 basis points per year, which is statistically indistinguishable from zero) that is reasonably close to that of the Vanguard fund (-29 basis points per year, also insignificant). Thus, we conclude that actively managed funds beat the Vanguard Index 500 fund on a net return basis, but only before adjusting for the higher average returns accruing to the characteristics of active fund stock holdings. Whether this adjustment can be viewed as wholly a compensation for risk is left for the reader (and the investor) to judge.

IV. Conclusion

In this paper, we measured the performance of the mutual fund industry from 1975 to 1994, and we decomposed fund returns and costs into various components. This decomposition is made possible by employing a new database not previously available to researchers. This database is created by merging a database of mutual fund holdings with a database of mutual fund net returns, expenses, turnover levels, and other characteristics. With the database, we are able to address issues that have been problematic to the study of mutual fund performance for decades—for example, we provide an estimate of quarterly transactions costs for each mutual fund in our sample to determine the role of trading costs in the performance puzzle.

Our results over the 1975 to 1994 period indicate that mutual funds held stock portfolios that outperform a broad market index (the CRSP value-weighted index) by 1.3 percent per year. About 60 basis points is due to the higher average returns associated with the characteristics of stocks held by the funds, whereas the remaining 70 basis points is due to talents in picking stocks that beat their characteristic benchmark portfolios.

However, on a net-return level, the funds underperform broad market indexes by one percent per year. Of the 2.3 percent difference between the returns on stock holdings and the net returns of funds, 0.7 percent per year is due to the lower average returns of the nonstock holdings of the funds during the period (relative to stocks). The remaining 1.6 percent per year is split almost evenly between the expense ratios and the transactions costs of the funds. Thus, considering only their stock holdings, mutual fund managers hold stocks that beat the market portfolio by almost enough to cover their expenses and transactions costs, which is consistent with the equilibrium model of Grossman and Stiglitz (1980). Mutual fund holdings of cash and bonds, presumably to maintain liquidity in the face of uncertain investor inflows and redemptions, put a substantial drag on the net returns of funds relative to the market.

We also find that mutual fund trading has more than doubled from 1975 to 1994. However, even with the substantially higher level of trading, total transactions costs, in 1994, are about one-third their level in 1975. Our evidence also shows that high-turnover funds, although incurring substantially higher transactions costs and charging higher expenses, also hold stocks with much higher average returns than low-turnover funds. At least a portion of this higher return level is due to the better stock-picking skills of managers of high-turnover funds. Although these high-turnover funds have negative (but insignificant) characteristic-adjusted net returns, their average unadjusted net return over our sample period significantly beats that of the Vanguard Index 500 fund.

Further research is warranted in examining the precision with which our characteristic benchmarks describe the choice set (related to average returns) from which funds normally choose stocks. For example, our finding of a selectivity measure of about 70 basis points per year may underestimate stock-picking talents, if funds prefer stocks with greater liquidity (a characteristic associated with lower average stock returns). In addition, a new inquiry into the performance persistence issue with our new database seems clearly warranted.

Finally, all of our results ignore the higher tax burden of actively managed (especially high-turnover) funds. Of great current interest is whether managers of actively managed funds add value, net of taxes.

Appendix A

Description of Matching Process for CDA and CRSP Mutual Fund Databases

In this section, we describe the process used to match the CDA mutual fund holdings database and the CRSP mutual fund net returns and characteristics database. The CDA database consists of the following information for each U.S.-based equity fund at the end of each quarter from December 31, 1974 to December 31, 1994 (inclusive):

1. Fund name and management company name
2. Date of mutual fund holdings "snapshot" (since June 30, 1979)
3. Total net assets under management
4. Self-declared investment objective (since June 30, 1980, supplemented with data for December 31, 1974)
5. Shares held of each stock by each fund

The majority of mutual funds use a fiscal quarter that coincides with calendar quarters; therefore, for this study, we use the approximation that all holdings reported within a given calendar quarter are also valid for the end of that calendar quarter (adjusting for stock splits). We also note that individual funds are only required to report their holdings to the SEC at the end of each fiscal semiannual period under Section 30 of the Investment Company Act of 1940. However, CDA obtains more frequent holdings reports from the majority of funds—during most of our sample period, over 80 percent of funds reported holdings on a quarterly basis to CDA. Further details on the data collection procedure by CDA are available in Wermers (1999). The CRSP mutual fund database consists of the following information for each U.S.-based equity fund from January 1, 1962, to December 31, 1997 (inclusive):

1. Fund name and management company name (management company name only since 1992)
2. Self-declared investment objective (annually)
3. Total net assets under management (monthly)
4. Net return (monthly)
5. Expense ratio (annually)
6. Turnover ratio (annually)
7. Proportion of portfolio allocated to stocks (annually)
8. Total load fee (annually)

Before matching funds between the two databases, we excluded several types of funds from the CRSP database. These funds include international funds, bond funds, money market funds, sector funds, and funds that do not hold the majority of their portfolios in U.S. equities. Such funds were identified through their self-declared investment objective or through a keyword in their name (e.g., the "Franklin Gold Fund"); in addition, funds holding less than 50 percent of their total portfolio value in equities during all years that they were in existence (during our sample period) were excluded.

Because the two databases (unfortunately!) have different fund numbering systems, we matched funds between them primarily based on the name of the fund. Occasionally, attempts at matching funds solely with the fund name proved difficult—in such cases, the investment objective, management company name, and total net assets information helped in matching funds between databases.

In matching funds by their names, we implemented a complex matching program that found name similarities between all versions of CDA fund names and all versions of CRSP fund names. In many cases, the program identified

an exact match between names in each database. However, in many other cases, the fund name in one database contained an abbreviation or a contraction, which made matching more difficult. For each fund, we hand-checked potential matches before deciding on the correct match and adding the matched fund to our database.

Panel A of Table I presents statistics, both for the funds that were successfully matched and for funds in the CRSP database that could not be matched to a CDA fund during the fund's entire existence. A total of 1,788 funds are included in the matched database, which consists of funds that survive until the end of 1994 and funds that perish due to a merger or liquidation. This number is slightly smaller than the 1,892 funds reported by Carhart (1997) that exist during 1962 to 1993 in the CRSP database, even though we include balanced funds, whereas Carhart does not. There are a few reasons for this. First, Carhart's time period begins in 1962, and our study begins in 1975. Second, Carhart apparently counts each share-class in a single fund as a separate "fund." Third, it is likely that our sample excludes some funds that were erroneously included in Carhart's count, because we use investment objective information from both the CDA and CRSP databases to decide on funds to include. And, fourth, we were unable to match 60 funds in the CRSP database toward the end of our sample period.

The reader should note that the yearly counts (either for matched or for unmatched funds) in Table I, Panel A, do not include funds with an incomplete data record during a given year. In general, CDA is slower in adding funds to their database than CRSP. This results in an incomplete record (missing stock holdings data) for some new funds, which reduces our fund count during most years in the merged database. These fund-year omissions should have a minimal impact on the majority of our results, however, because we average our fund measures by the total net assets of funds (thus minimizing the importance of small, omitted funds).

The CDA data omission problem notwithstanding, any funds that could not be matched (during their entire existence) were ones that were listed in the CRSP database but not in the CDA database (at least among diversified equity funds). The small, unmatched funds during the last few years of our sample period are likely ones that CDA did not add to their database until after 1994.

Also noteworthy is that CRSP identifies different shareclasses of the same mutual fund as distinct funds. Table I, Panel B, provides counts of the number of shareclasses represented by our mutual fund sample. Such shareclasses, which became especially prevalent during the 1990s, confer ownership to the same underlying pool of assets while providing different expense ratio and load fee structures to appeal to different clienteles. Returns on the various shareclasses corresponding to a single mutual fund are obviously not independent, and CDA does not separately identify such shareclasses. Therefore, we recombine all CRSP shareclasses of a mutual fund by mapping them to a single CDA fund. In doing so, we compute net returns, expense ratios, and load fees for the parent CDA mutual fund by weighting the figures for each shareclass by the most recent total net assets of that shareclass. We note,

however, that CRSP likely omits many shareclasses that are offered only to institutions. The impact of this omission is probably an overestimate of fund expenses, however, as institutions generally pay lower expenses and loads.

Appendix B

Description of Execution Cost Estimation Procedure

Keim and Madhavan (1997) provide the following fitted regressions for total institutional execution costs (commissions plus market impact) for a sample of mutual funds during the 1991 to 1993 period:

$$C^B_{i,t} = 0.767 + 0.336D^{Nasdaq}_{i,t} + 0.092\,Trsize_{i,t} - 0.084\,\mathrm{Log}(mcap_{i,t}) + 13.807\left(\frac{1}{P_{i,t}}\right) + 0.492D^{Tech}_{i,t} + 0.305D^{Index}_{i,t} \tag{B1}$$

and

$$C^S_{i,t} = 0.505 + 0.058D^{Nasdaq}_{i,t} + 0.214\,Trsize_{i,t} - 0.059\,\mathrm{Log}(mcap_{i,t}) + 6.537\left(\frac{1}{P_{i,t}}\right) + 0.718D^{Tech}_{i,t} + 0.432D^{Index}_{i,t}, \tag{B2}$$

where

$C^B_{i,t}$ = total costs (in percentage of the trade value) of buying stock i during period t,
$C^S_{i,t}$ = total costs (in percentage of the trade value) of selling stock i during period t,
$Trsize_{i,t}$ = trade size (dollar value of trade divided by market capitalization of the stock),
$\mathrm{Log}(mcap_{i,t})$ = natural log of the market capitalization of the stock (expressed in thousands),
$P_{i,t}$ = the stock price, and
$D^{Nasdaq}_{i,t}$, $D^{Tech}_{i,t}$, $D^{Index}_{i,t}$ = dummy variables that equal one if the trade occurred on Nasdaq (as opposed to the NYSE or AMEX), if the trader was a "technical trader," and if the trader was an "index trader," respectively, and zero otherwise.

Because we cannot easily assign trader types (value, technical, or index) to our mutual funds, we use the data on the fraction of each trader type present in the Keim and Madhavan (1997) study to recompute the fitted regressions without trader dummies. Also, because trading costs declined substantially on all markets over our sample period, we use the results of Stoll (1995), who estimates the time − series trend of total execution costs in the different markets. Specifically, the average cost of executing a trade is documented over time on both the NYSE/AMEX and on the Nasdaq. Using

1992 (the middle trading year studied by Keim and Madhavan (1997)) as our baseline year, we adjust the fitted regressions with a "year factor," Y_t^k, that is equal to the average execution cost during the year in which period t falls divided by the 1992 average execution cost for market k (where k = NYSE/AMEX or Nasdaq). These factors are based on Stoll (1995). The resulting fitted regressions are used to estimate the cost of buying or selling stock i during quarter t:

$$C_{i,t}^B = Y_t^k \cdot \Bigg[1.098 + 0.336 D_{i,t}^{Nasdaq} + 0.092\, Trsize_{i,t} - 0.084 \,\mathrm{Log}(mcap_{i,t}) + 13.807 \left(\frac{1}{P_{i,t}} \right) \Bigg] \tag{B3}$$

and

$$C_{i,t}^S = Y_t^k \cdot \Bigg[0.979 + 0.058 D_{i,t}^{Nasdaq} + 0.214\, Trsize_{i,t} - 0.059 \,\mathrm{Log}(mcap_{i,t}) + 6.537 \left(\frac{1}{P_{i,t}} \right) \Bigg]. \tag{B4}$$

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