Mutual Fund Costs: Risk Without Reward

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Overview

Why does a mutual fund investor choose one particular fund over another? Presumably it's with the hope that the chosen fund will beat the "market average" for its category. But how often do fund investors actually realize their dreams of superior performance? More to the point, what, if anything, can an investor do to improve the odds of selecting a winning fund, and to reduce the risk of getting stuck with a losing fund? The answer is surprisingly simple: invest only in low-cost funds and avoid high-cost funds.

Mutual funds come with three types of costs: *fees*, *transaction costs* and *taxes*. The manager deducts his *fee* whether the market goes up or down, and whether or not the fund beats the market. When the manager buys or sells securities, the fund pays *transaction costs*, (e.g. commissions and spreads to brokers and market makers). When the fund sells its holdings at a profit, its shareholders pay *taxes* on the gains. All of these costs reduce the wealth that the fund delivers to the investor. This isn't inherently unreasonable. If a fund costs $1, but beats the market by $2, the investor is still better off in the end and everybody wins. If only it worked out that way. As this paper illustrates, a mutual fund's costs do *not* purchase superior returns, they only reduce the fund's expected returns. The higher a fund's costs, on average, the lower its returns. These costs add up over time and can consume an astonishing amount of the investor's potential wealth.

Low-cost funds are not guaranteed to perform well, and high-cost funds do not always perform poorly. But think of mutual fund costs as *unrewarded risk*. We studied the long-term performance of several different types of mutual funds. Our analysis shows that with higher fund costs come lower expected returns, lower chances for outperformance, and a greater risk of underperformance. Within every category of funds that we studied, funds with low *expense ratio* (fees) and low *turnover* (=low transaction costs) offered the most satisfactory results among their peers.

We analyzed the ten-year cumulative performance records of open-end mutual funds in existence from December 1991 through December 2001, with particular attention to the following:

- The 10-year track records of Larger-Cap U.S. stock funds relative to the S&P 500 Index, both before and after taxes. [See *Definitions and Methodology* section below for definition of Larger-Cap]
- The impact of portfolio turnover on cumulative returns for various categories of funds.
- The impact of expense ratio on cumulative returns for various categories of funds.
- A comparison of cumulative after-tax returns of general U.S. Government Bond funds versus Municipal Bond funds.

Our findings are consistent with previous studies (see the Endnotes for references). Even without considering the impact of loads, the average Larger-Cap stock fund underperformed the S&P 500 by a substantial margin, and a much larger number of funds underperformed the index than outperformed the index. On average, lower expense funds outperformed higher expense funds, and lower turnover funds outperformed higher turnover funds by a substantial margin in every category of funds that we studied. Finally, taxable government bond funds, on average, underperformed municipal bonds net of taxes for investors of every tax bracket.

Our analysis confirms that one of the simplest and most reliable ways for an investor to improve her odds of investment success is to ensure that she is investing in reasonable-cost, low-turnover and tax-efficient investment vehicles of the appropriate asset classes.

The rest of this paper includes detailed summary statistics, followed by commentary and analysis, discussion of definitions and methodology, and a section of data tables and graphs.

Summary Statistics and Conclusions

Larger-Cap Funds and the S&P 500

A $1 investment in the S&P 500 on December 31, 1991 would have grown to a *terminal value* of $3.38 on

December 31, 2001 (assuming reinvestment of all dividends). This implies an average annual return of 12.95%. Under the tax assumptions described below, this would be worth $2.76 net of tax, for an average annual after-tax return of 10.69%. But how many mutual funds actually met or exceeded these benchmarks? Not many.

A $1 investment in the average actively-managed Larger-Cap U.S. stock fund would have been worth $2.94 before tax ($2.31 after-tax), representing 87% (83% after-tax) of the potential of the unmanaged index, for an average annual return of 11.38% (8.73% after-tax). On a pre-tax basis, 25% of the funds outperformed the S&P 500, while 75% underperformed; 14% of the funds beat the S&P 500 by an average annual margin of 1%, while 58% underperformed by more than 1%.

On an after-tax basis, only 14% of the Larger-Cap funds beat the S&P 500, while 86% underperformed; 6% beat the index by more than a 1% average annual margin, and 71% underperformed the S&P 500 by more than 1% per year.

In other words, looking at the after-tax outcomes, an investor would have been about six times more likely to pick a losing fund than a winning fund, and about 12 times more likely to pick a big loser than a big winner. In fact, since our analysis was limited to funds that survived for the entire 10-year period, we've eliminated from consideration the many funds that went out of business on account of poor performance. The odds of picking a winning fund in practice, without the benefit of hindsight, would have been even lower than our numbers suggest.

The sections below deal with the impact of expense ratio and turnover on investment outcomes. We shall see that lower expense funds had better outcomes than higher expense funds on average when measured both by absolute returns and in relation to the S&P 500, before taxes as well as after taxes. Similarly, lower turnover funds had better outcomes than higher turnover funds.

The Impact of Expense Ratio

We examined the impact of expense ratio by ranking all funds in each category by expense ratio and assigning each fund into an Expense Ratio Decile, where the 1st Decile contains the 10% of funds in the category with the lowest expense ratios, and the 10th Decile contains the 10% with the highest expense ratios, etc.

For each category of fund in the following table, we show the average annual pre-tax and after-tax returns for both the lowest and highest expense-deciles for the category, along with the cut-off points that determine membership in the deciles. (The lowest cost funds are in the top row in yellow, the highest cost funds below in gray. The average expense ratio and average returns for the category are in the middle row).

With one exception, the low cost funds outperformed their category, on average. In every case the highest-cost funds performed substantially below their category, on average.

Scatter plot diagrams illustrating some of these data series are included under "Data Tables and Charts" below

Fund Style	Expense Ratio	Average Annual Pre-Tax Return	Average Annual After-Tax Return
Larger-Cap U.S. Equity	< 0.65%	12.7%	9.6%
	1.07%	11.1%	8.5%
	> 1.60%	10.0%	7.7%
Smaller-Cap U.S. Equity	< 0.76%	11.5%	9.1%
	1.21%	11.8%	9.1%
	> 1.83%	9.9%	8.5%
International Equity	< 0.85%	8.2%	6.1%
	1.35%	7.2%	5.5%
	> 2.17%	5.3%	4.2%
Municipal Bonds	< 0.55%	6.0%	5.8%
	0.85%	5.7%	5.6%
	> 1.18%	4.5%	4.7%
U.S. Government Bonds	< 0.60%	7.0%	4.1%
	0.96%	6.2%	3.6%
	> 1.53%	5.3%	2.9%

Table 1

The Impact of Turnover

A fund's *turnover* measures the frequency at which the fund trades its assets. Very roughly, 100% turnover implies that the fund's assets are sold and replaced once a year on average, 200% turnover means that the fund's assets are replaced every six months on average. Whenever a fund buys and sells assets it incurs transaction costs. These costs include commissions, bid/ask spreads, and *market impact costs*. The latter is significant when a fund buys or sells positions large enough to significantly increase the supply or demand for a security, and therefore move the price unfavorably. (See *The Plexus Group* for extensive commentary regarding transaction costs for institutional investors[8]) The higher a fund's turnover, the higher its transaction costs. We examine the effect on performance.

Overall Results

We find a consistent negative relationship between fund turnover and performance in every category of fund that we examined. In Larger-Cap U.S. equity funds, we observed that on average, each 100% of turnover was expected to reduce the fund's average annual pre-tax return by 124 bps (1.24%). Similarly, each 100% of turnover was shown to reduce the expected annual return by 255 bps for Smaller-Cap U.S. funds, 154 bps for International Equity funds, 43 bps for Municipal Bond funds and 9 bps for U.S. Government Bond funds. These results are within the range of other studies that have examined the costs of institutional trading and the relationship between fund turnover and performance. (See Appendix A for a comparison with other studies.)

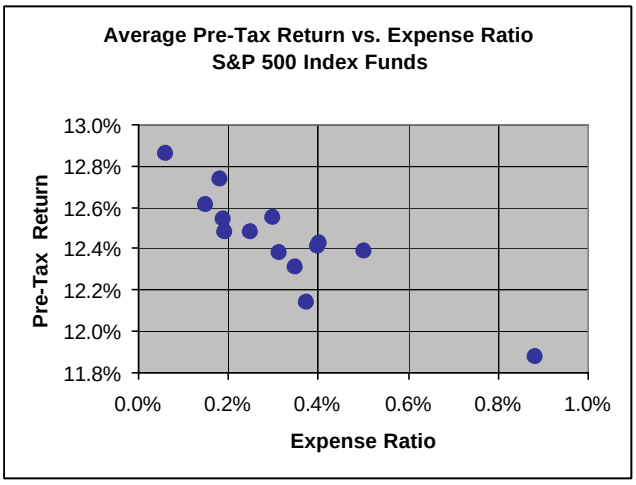
Larger-Cap Funds

As shown above, the investor in Larger-Cap funds had only a modest hope of beating the S&P 500. One could have improved one's outcome by selecting low-turnover funds instead of high-turnover funds. For Larger-Cap funds, the average low turnover fund would have been worth 26% more than the average high turnover fund on a pre-tax basis, or 21% more after all taxes are paid.

While 31% of the lowest-turnover Larger-Cap funds beat the S&P 500 for the 10-year period on a pre-tax basis, only 20% of the highest-turnover funds could make the same claim. In an after-tax comparison, 24% of the lowest-turnover funds beat the tax-adjusted S&P 500, but only 10% of the highest-turnover funds the benchmark. Only 5% of the highest-turnover funds beat the index by more than 1% per year, while 80% underperformed the S&P 500 by more than 1% per year.

Comparison with S&P 500 Index Funds

Our sample of Larger-Cap funds included only actively managed funds (i.e. we specifically excluded S&P 500 index funds from this subset). However, a separate test of S&P 500 index funds confirms our basic hypotheses about turnover, expense ratio and performance. The *average* S&P 500 fund in the sample had a turnover of 8%, an expense ratio of 0.33%, with pre-tax terminal value (average return) of $3.23 (12.45%), and after-tax terminal value (average return) of $2.52 (9.68%), beating about 70% of all other Larger-Cap funds both pre-tax and after-tax. The least expensive retail S&P 500 fund beat 73% of the actively managed funds pre-tax, and 76% after-tax.



We computed a multiple linear regression on the sample of S&P 500 funds, and found the following relationship:

R = 12.90% - 119bps*__T__ – 1.12*__E__

where **R** is the fund's average-annual pre-tax return for the ten-year period, and **T** and **E** are respectively Turnover and Expense-Ratio as used elsewhere in this document.

This formula confirms that the cost of trading is similar to that of other Larger-Cap funds, and that an index fund's expected return is essentially the return of the index less management fees and trading costs.

Figure 1

Taxable versus Tax-Exempt Bond Funds

We find that owning taxable (long-term) U.S. Government Bond funds in a taxable account would have been inadvisable for any investor, regardless of tax bracket. While the average pre-tax terminal value for U.S.

Government Bond funds was $1.83, this falls to $1.47 after tax for our canonical investor, compared with $1.72 for the average Municipal Bond fund in the sample. Even for an investor in the 15% federal tax bracket and not subject to state tax, the average U.S. Government Bond fund would have had an after-tax terminal value of $1.67.

The above notwithstanding, these long-term U.S. Government Bond funds would still have delivered higher total returns than municipal bond funds for any investor if held in an IRA, 401(k) or any other tax-sheltered account. (Our analysis covered only long-term bond funds; shorter-term funds might have had different results).

Analysis and Commentary

Investment costs as a risk factor

The traditional academic definition of investment "risk" is *volatility*, or standard deviation of returns. But this definition probably doesn't correspond precisely with the way that most individual investors think about risk. Most people, I suspect, would define risk along the lines of "losing money", "having terrible returns", or "falling short of one's goals". True, under these conceptions of risk, "volatile" implies "risky" because in practice, volatile assets also have a significant probability of downside. But volatility is only part of the story. Consider two mutual funds that invest in exactly the same assets, but one charges a 0.5% annual fee, the other charges 1.5%. The two funds fluctuate in lockstep, except that the return of the more expensive fund always lags the return of the other fund by exactly 1% a year. These funds are equally volatile, and therefore equally "risky" under the standard definition. But obviously, the fund with the higher cost and lower returns is more likely to deliver a bad outcome. In other words, with all else being equal: the higher the cost, the greater the risk, at least under definitions of risk that the average person would find useful.

The following graphs illustrate one way to think about the risk of poor performance. **Figure 2** shows the distribution of all Larger-Cap funds relative to the S&P500 on an after-tax basis. For example, the tallest red bar shows that about 23% of the funds in the sample (97 out of 415) had an average annual after-tax return that was between 2% and 3% *below* the average annual after-tax return of the S&P 500. On the other hand, the shortest green bar on the right shows that fewer than 1% of the funds (2 out of 415) *beat* the S&P 500 by a margin of between 4% and 5%. We can divide the funds into 4 groups: Big Winners, which beat the S&P 500 by more than 1% a year on average (shown in the graph in dark green), Modest Winners, which beat the S&P 500 by less than 1% a year (light green), Big Losers, which lagged the S&P 500 by more than 1% a year on average (dark red) and Modest Losers, which lagged the S&P 500 by less than 1% a year (pink).

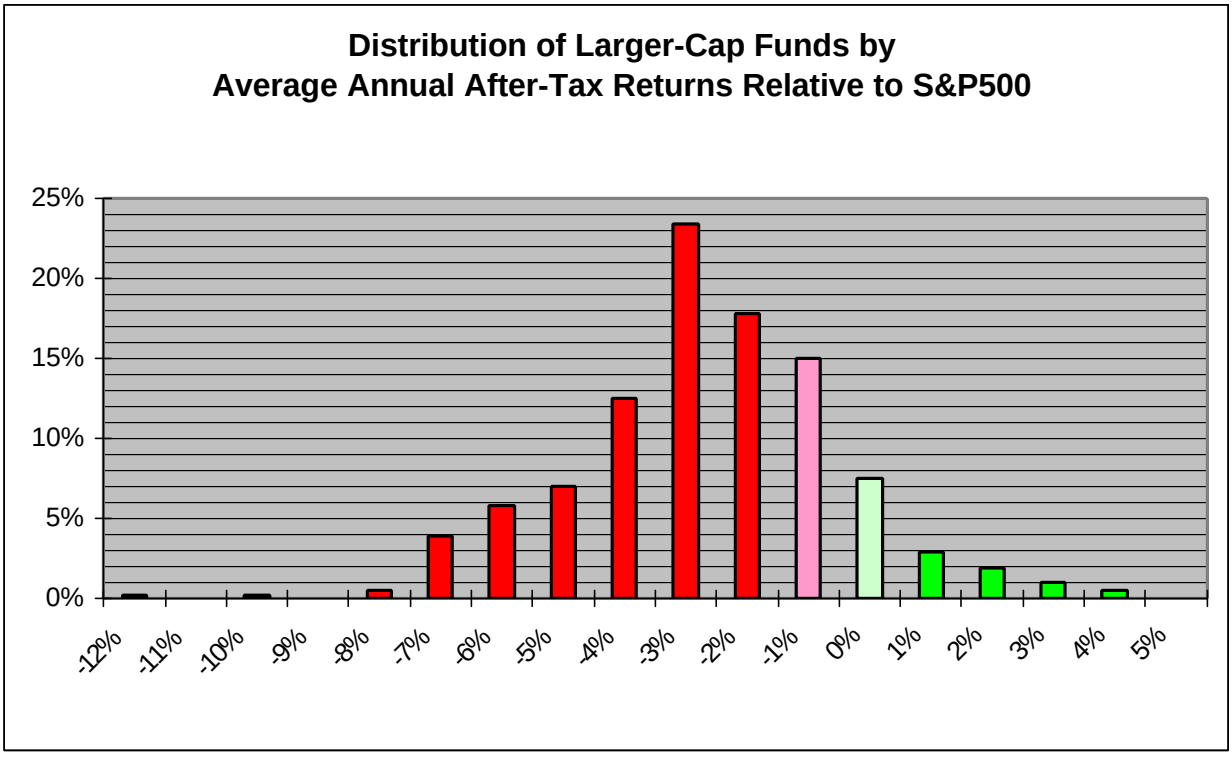


Figure 2 (for a table with all of these data points, see Table 10, on page 16)

Think of the red area in **Figure 2** as the risk of having a disappointing outcome. In raw numbers, the odds are: 71% of getting a Big Loser, 15% of getting a Modest Loser, 7% Modest Winner, 7% Big Winner. The most efficient index funds, by the way, will be Modest Losers, because they always lag the index by the amount of their fees, costs and taxes.

Figure 3 applies the above analysis to show how different types of Larger-Cap funds fared relative to the S&P 500 on an after-tax basis. The graph illustrates how the downside risk increases, and the upside opportunity decreases, with increasing costs. We look at the following five subsets of Larger-Cap funds: All such funds (blue bars); the 10% with the highest expense ratio (yellow bars); the 10% with the lowest expense ratio (red bars); the 10% with the highest turnover (purple bars); the 10% with the lowest turnover (light blue bars). Similar to **Figure 2**, we show the Big Losers, Modest Losers, Modest Winners and Big Winners for all 5 subsets. The tall bars on the left show the Big Losers. Think of these tall bars as representing the risk of having a disappointing outcome by getting stuck with a Big Loser. The short bars on the right show the likelihood of scoring a Big Winner.

For example, the tallest yellow bar shows that 85% of the highest-expense funds were Big Losers, and the shorter yellow bars show that 7% of the highest-expense funds where Modest or Big Winners. On the other hand, the red bars shows that 46% of the lowest-expense funds were Big Losers, and 17% were Modest or Big Winners. Similarly, by comparing the heights of the light blue bars vs. the purple bars, we see that low-turnover funds had fewer Big Losers and more Winners than high-turnover funds. The lesson: the least expensive funds offer the highest chances of success, and the lowest risks of disappointment.

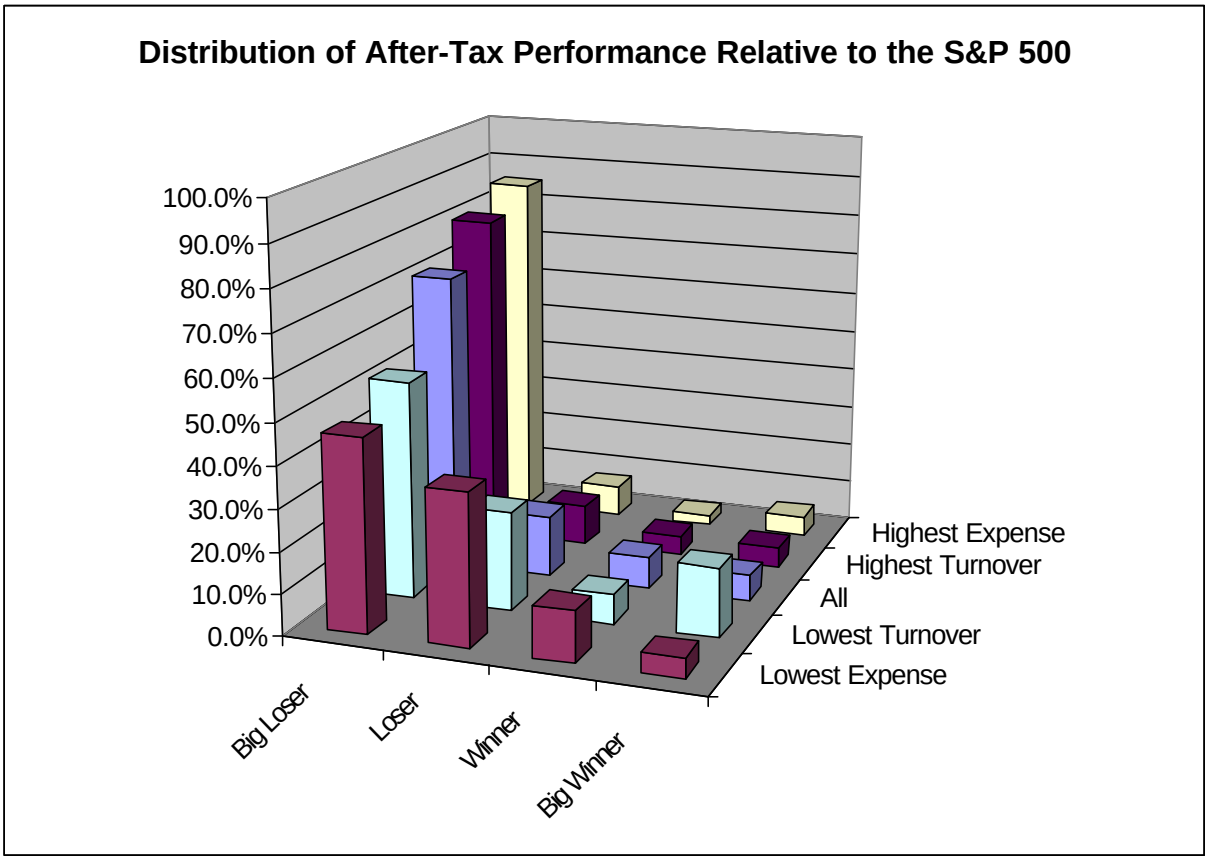


Figure 3 (for a table with all of these data points, see Table 11, on page 16)

Implications for investor education and financial planning

Most of us have seen an impressive chart illustrating the exponential growth of the U.S. stock market from the early 20th century to the present. A recent mailing from a well-known brokerage included an Ibbotson chart claiming that $1 invested in the S&P500 at the beginning of 1926 would have been worth $2,279 at the end of 2001 (an average annual return of 10.7%). Those who read the fine print discover that the results assume no taxes or transaction costs. Since real investors do pay taxes, transaction costs *and* management fees, one wonders how close a real investor's outcome might have been to Ibbotson's theoretical illustration.

Let's see what happens when we apply the operating costs and tax-efficiency of the *average* fund in our 10-year study to Ibbotson's S&P 500 numbers for the period from 1926-2001. During the 10-year period ending 2001, $1 in the ideal S&P 500 grew to $3.38 before taxes, for an average annual return of 12.95%. The average Larger-Cap mutual fund was worth $2.94 before taxes, for 87% of the ideal index value, and an average annual return of 11.4%. After taxes, the average Larger-Cap fund was worth $2.31, for 68% of the ideal index value and an average annual return of 8.7%. This implies that the average fund had a total operating cost (expense ratio plus transaction costs) of 1.55% annually, and distributed each year as realized capital gains the equivalent of 75% of its long-term average annual capital return. The following table shows the performance of a hypothetical fund that applies these cost assumptions to the Ibbotson S&P 500 returns during 1926-2001[1], both with and without taxes. As a comparison we also show the performance of a hypothetical S&P 500 index fund during the same period. (The latter should not be interpreted as a recommendation for any index fund, only as an example of the practical limits of achieving the theoretical index returns). All of these numbers are adjusted for inflation, to represent the investor's final purchasing power relative to his initial $1 investment.

Scenario	Annual Operating Cost	Tax Assumptions	Terminal Value	Average Annual Return
Ideal S&P 500	0%	No taxes	$228	7.4%
S&P500 index fund	0.40%	No taxes	$170	7.0%
Average large-cap fund	1.55%	No taxes	$70	5.8%
S&P500 index fund	0.40%	Taxes on dividends only, no capital gain distributions; capital gain taxes paid upon liquidation in 2001	$35	4.8%
Average large-cap fund	1.55%	Taxes on dividends and average capital gains distributions paid each year, capital gain taxes paid upon liquidation in 2001	$9	2.9%

Table 2

Now none of the above numbers are all that bad, and the outcome in every scenario is still better than the outcome of similar investments in bonds or treasury bills (both of which would have *lost* purchasing power after costs and taxes). But none of the results in the above table are quite the same as $2,279 and 10.7%.

Another data point from our study tells us that the average international stock fund would have been worth 15% more than the average municipal bond fund before taxes, but slightly less than the average municipal bond fund after taxes, and with higher volatility. Whether or not this 10-year period is typical of the past or indicative of the future is difficult to say, but the result might surprise some people who recommend and/or hold international funds in taxable accounts.

Clearly there are enormous differences between theoretical asset class returns and spendable investment results in a world with investment costs, taxes and inflation. Unfortunately, some in the financial industry focus too often on the theoretical world of pure asset classes and not often enough on the real world of actual investors. Some financial planning exercises and asset allocation programs incorporate costs and taxes in their models. Incredibly, many others do not. As a whole, the financial media and intermediaries could do more to help investors set more realistic expectations for themselves.

"Index" does not mean "Average", "Index" means "Par"

Given the success of so few funds and the failure of so many funds to beat the S&P 500, we think it's time to stop referring to the S&P 500 and other indexes as the "market averages". Many investors, apparently, eschew index-based investments under the mistaken perception that index performance is merely "average", and why should any good American settle for mediocrity? It is simply not correct to imply that index performance is "average" when it is so far above the performance of the average mutual fund. Instead, the financial industry and media should reposition the indexes as "par for the market", as in par for a golf course where only the best golfers consistently shoot par.

Clearly, there were a number of funds that beat par for the 10-year period that we studied. For some funds this success might be the result of a repeatable skill that will persist for the next 10 years. For other funds, their good fortune might simply be a lucky 'hole-in-one'. We don't claim to know which explanation goes with which fund. What we did learn was that expense ratio and turnover are akin to a golfer's handicap. The higher the handicap of

expense ratio and turnover, the lower the odds of shooting par and matching (let alone beating) the index. It's conceivable, of course, that a high-handicap golfer could win the U.S. Open, but it's seldom profitable to place bets on such a golfer. Before an investor bets that a particular fund will shoot under par, she should convince herself that the fund manager's game plan is compelling enough to overcome the fund's handicap of expenses and transaction costs. In other words, what is it about the manager that is likely to make him one of the few Big Winners, instead of one of the many Big Losers? Short of having solid faith in a specific fund manager, an investor can also feel good about settling for a reasonably priced index-based strategy that has excellent odds of delivering above-average results.

More disclosure, please

Hopefully this paper helps explain the significance of transaction costs as a factor that drives fund performance. Our website, at www.personalfund.com , has tools which help investors estimate and understand mutual fund costs, including transaction costs. But we would prefer not to be in the business of estimating transaction costs. Our estimates are at best, well, estimates. We encourage fund managers to disclose their actual transaction costs, just as they disclose other critical data about their funds. As unabashed fans of the free market, we prefer to believe that voluntary disclosure is the best solution, but we also call on Congress and the SEC to press the fund industry for greater transparency in regard to transaction costs.

In the meantime, there is a free market solution. Investors can vote with their wallets and opt for separately managed accounts in lieu of mutual funds. Separate accounts have their own fees, transaction costs and tax consequences, and investors should understand exactly what those costs are. In some cases, at least, the costs of separate accounts are more transparent than the costs of mutual funds. Investors should carefully compare their various alternatives, and the costs that each alternative entails, before deciding which managers – whether mutual fund or separate account – earn the right to manage their assets. We believe that every investor should have access to all the information she needs in order to make an informed decision.

Definitions and Methodology

Data Set

We use the Lipper mutual fund database from Lipper, Inc, a Reuters company. The database includes 1,814 long-term open-end funds that have been in existence during the entire period from December 31, 1991 to December 31, 2001. For each fund in the universe we use the following data items:

- Fund style classification, as determined by Lipper[2]
- Net Asset Value (NAV) for the last day of each calendar year in the period
- Total per-share income and capital gains distributions for each calendar year in the period
- Reported turnover for each calendar year in the period
- Expense Ratio, as reported on June 30, 1999.

Survivor Bias

Note that the study includes only funds that have been in existence for the entire ten-year period. Hence the study is limited by "survivor bias". Carhart has shown that non-surviving funds have higher turnover on average than surviving funds[3]. Malkiel has shown that non-surviving funds have substantially lower returns than surviving funds[4]. Therefore we believe that our methodology underestimates the impact of turnover on long-term returns.

Fund Classification

Based on Lipper's classification system, we combine funds from multiple Lipper categories into more general categories, as follows:

General Category	Lipper Categories
Larger-Cap U.S. Equity	Multi-Cap Core / Value / Growth Large-Cap Core / Value / Growth Equity Income
Smaller-Cap U.S. Equity	Mid-Cap Core / Value / Growth Small-Cap Core / Value / Growth
International	International, Global
Municipal Bond	All multi-state and single-state long-term municipal bond fund categories, excluding insured and short/intermediate categories
U.S. Government Bond	General U.S. Treasury, General U.S. Government, GNMA

Table 3

We rely on Lipper's classification as of June 1999, which is the most recent that was available to us. By assigning funds to the broad categories above, we believe we avoid issues of style drift and migration that would exist if we were to rely on a more narrow classification.

Calculation of Pre-Tax Terminal Value and Annualized Returns
For each fund we calculate the pre-tax Terminal Value as follows:

1. Invest $1 in the fund using the NAV as of December 31, 1991
2. For each calendar year in the period, hold any income or capital gains distributions received during that year, and reinvest them in the fund on December 31 of that year using the NAV for the last day of the year.
3. The Terminal Value is then the total value of the original investment and reinvested distributions as of December 31, 2001

The annualized pre-tax return for a fund is therefore the geometric mean annual return, or

$$R = V^{1/10} - 1$$

where V is the Terminal Value as computed above.

In the case of U.S. equity funds, we compare fund Terminal Values against the Terminal Value of the S&P 500. We calculate the latter as the product of monthly return relatives of the S&P 500 total return series for the period in question, as reported by BARRA[5].

Tax Assumptions and Calculation of After-Tax Terminal Value
We base the after-tax analysis on a California taxpayer in the 36% federal bracket, which is the second highest federal bracket. Such a taxpayer would be in the 9.3% bracket in California for all types of income. Thus, the combined marginal tax rates are rounded to:

- Ordinary income – 42%
- Long-term capital gains – 26%

These rates are applied during every year in the period.

The Lipper database does not identify which proportion of a capital gains distribution is "long-term" and which is "short-term". We make a conservative assumption that all distributions are long-term. We believe that this assumption leads us to underestimate the impact of turnover on after-tax performance.

The After-Tax Terminal Value assumes that taxes are paid on annual distributions and that all shares of the fund are sold on the final date, with taxes paid upon the sale. We calculate the After-Tax Terminal Value as follows:

1. Invest $1 in the fund using the NAV as of December 31, 1991. The starting Cost Basis is $1.
2. For each calendar year in the period, hold any income or capital gains distributions received during that year. Adjust the distributions to subtract taxes by applying the ordinary income rate to income distributions and the long-term capital gains rate to capital gains distributions[6]. Reinvest the remaining portion in the fund on December 31 of that year using the NAV for the last day of the year. Add the dollar value of the reinvestment to the Cost Basis.
3. The Pre-Liquidation Terminal Value is then the total value of the original investment and reinvested distributions as of December 31, 2001
4. The After-Tax Terminal Value is calculated by subtracting from the Pre-Liquidation Terminal Value the "tax" at the Long-terms capital gains rate, based on the difference between the Pre-Liquidate Terminal Value and the Cost Basis.

In the case of U.S. equity funds, we compare fund after-tax Terminal Values against the after-tax Terminal Value of the S&P 500. To calculate the latter, we treat the index as a hypothetical "fund" that tracks perfectly the total return of the S&P500, but distributes no income or realized capital gains. The owner of such a fund would, however, pay capital gains taxes on any appreciation at the time of sale. I.e. the after-tax Terminal Value is given by the formula:

$$T_a = T_p - c(T_p - 1)$$

Where T_p is the pre-tax Terminal Value of the index as described above, and c is the prevailing marginal rate for long-term capital gains.

Estimation of Turnover Cost
We employ the following procedure to estimate the drag on performance attributable to turnover for each Category of fund:

1. Compute the Average Annual Turnover (AATurnover) for each fund during the period, as the arithmetic mean of the fund's 10 annual turnover values.

2. Compute for each fund in the Category the annualized pre-tax return, as above
3. Sort the funds in the Category into 10 Deciles in descending order of AATurnover, where each Decile has an equal number of funds[7]. Decile 1 has the funds with the lowest AATurnover, Decile 10 the funds with the highest AATurnover.
4. Compute for each Decile the mean AATurnover and the mean annualized return
5. Compute a simple linear regression, with the Decile mean AATurnover as the independent variable and the Decile mean annualized return as the dependent variable. The cost of Turnover, as reported in the Introduction above, is the slope coefficient in the regression.

Expense Ratio

For each fund we use the expense ratio, as reported by Lipper as of June 30, 1999, which is the earliest expense ratio data that was available to us. Admittedly, we would have preferred to use average expense ratio for the entire period. However, we focused our analysis on relative rankings between funds in a category, rather than the absolute expense ratio values. (Our internal study has shown that relative ranking of expense ratio is fairly stable – e.g. the lowest-fee funds tend to remain less expensive than their peers from one year to the next).

Data Tables and Charts

Outcomes by Turnover

Pre-Tax Annualized Returns

Category	Sample Size	Mean Annualized Return	Standard Deviation of Annualized Return	Transaction Cost
Larger-Cap U.S. Equity	415	11.10%	2.8%	124bps
Smaller-Cap U.S. Equity	159	11.25%	3.6%	255bps
International Equity	77	6.87%	2.8%	154bps
Municipal Bond	363	5.67%	0.8%	43bps
U.S. Government Bond	78	6.20%	0.7%	9bps

Table 4

The above table summarizes the average transaction cost per 100% of turnover for each type of fund that we studied.

The following tables and charts show the relationship between terminal values and turnover decile for the various types of funds in the study. The "Low/High Advantage" for each fund category shows the amount by which the average fund of the low-turnover Decile outperforms the average fund of the highest-turnover Decile

Larger-Cap U.S. Equity Funds								
Decile	**Mean Avg. Ann. Turnover**	**Max Avg. Ann. Turnover**	**Average Terminal Value Pre-Tax**	**Average Terminal Value After-Tax**	**Average Annual Return Pre-Tax**	**Average Annual Return After-Tax**	**S&P 500 Beaters Pre-Tax**	**S&P 500 Beaters After-Tax**
S&P 500			$3.38	$2.76	13.0%	10.7%		
1	15%	24%	$3.32	$2.59	12.5%	9.7%	31%	24%
2	29%	34%	$3.23	$2.48	12.2%	9.4%	32%	17%
3	39%	45%	$2.79	$2.19	10.6%	8.1%	19%	5%
4	51%	56%	$2.90	$2.28	11.0%	8.4%	22%	12%
5	63%	68%	$2.93	$2.29	11.1%	8.5%	21%	14%
6	72%	76%	$2.93	$2.31	11.2%	8.6%	20%	13%
7	83%	91%	$2.94	$2.28	11.2%	8.5%	23%	12%
8	100%	108%	$2.89	$2.27	10.8%	8.3%	25%	18%
9	122%	140%	$2.85	$2.26	10.6%	8.2%	33%	14%
10	193%	372%	$2.64	$2.14	9.7%	7.6%	20%	10%
All	76%	372%	$2.94	$2.31	11.1%	8.5%	25%	14%
Low/High Advantage			26%	21%				

Table 5

The "S&P 500" Beaters columns in the table above indicate the percentage of funds in each decile that beat the S&P 500

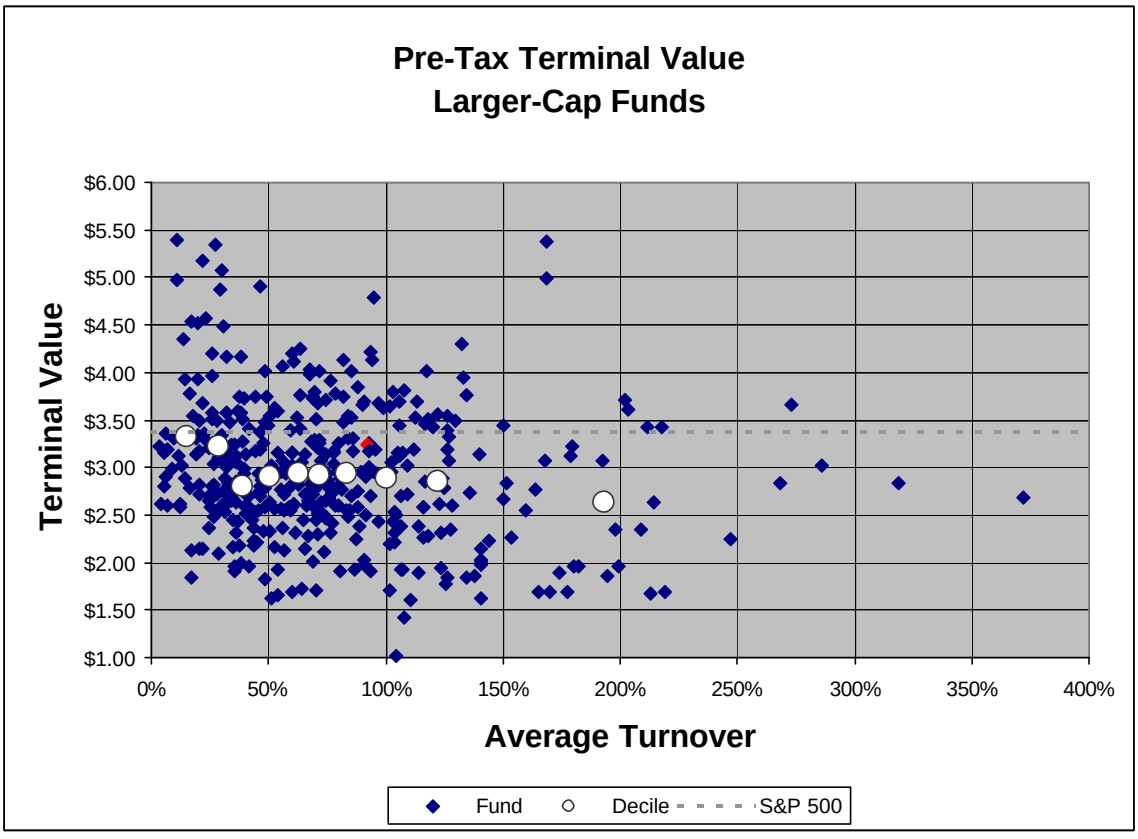


Figure 4

Each small diamond in the scatter plot graph represents one fund. For illustration purposes, the red diamond represents the largest fund in the group (the Fidelity Magellan Fund), which had an average turnover of 92% and a pre-tax terminal value of $3.23. (I.e. $1 invested in the fund on December 31, 1991 would have been worth $3.23 on December 31, 2001, ignoring all tax consequences. This also ignores any front-end or back-end loads that might have applied). The dotted line shows the terminal value of the S&P 500, at $3.38. We see that there is a wide range of outcomes. However, when we rank and group funds by turnover, a pattern emerges. The 10% of the Larger-Cap funds with the lowest turnover had, as a group, an average turnover of 15% and an average terminal value of $3.32.

On the other hand, the 10% of the Larger-Cap funds with the *highest* turnover had an average turnover of 193% and an average terminal value of $2.64. The 10 *Deciles* of funds ranked by turnover are represented in the graph by the larger white circles. The conclusion is that lower turnover Larger-Cap funds on average, offered higher pre-tax returns than higher turnover funds.

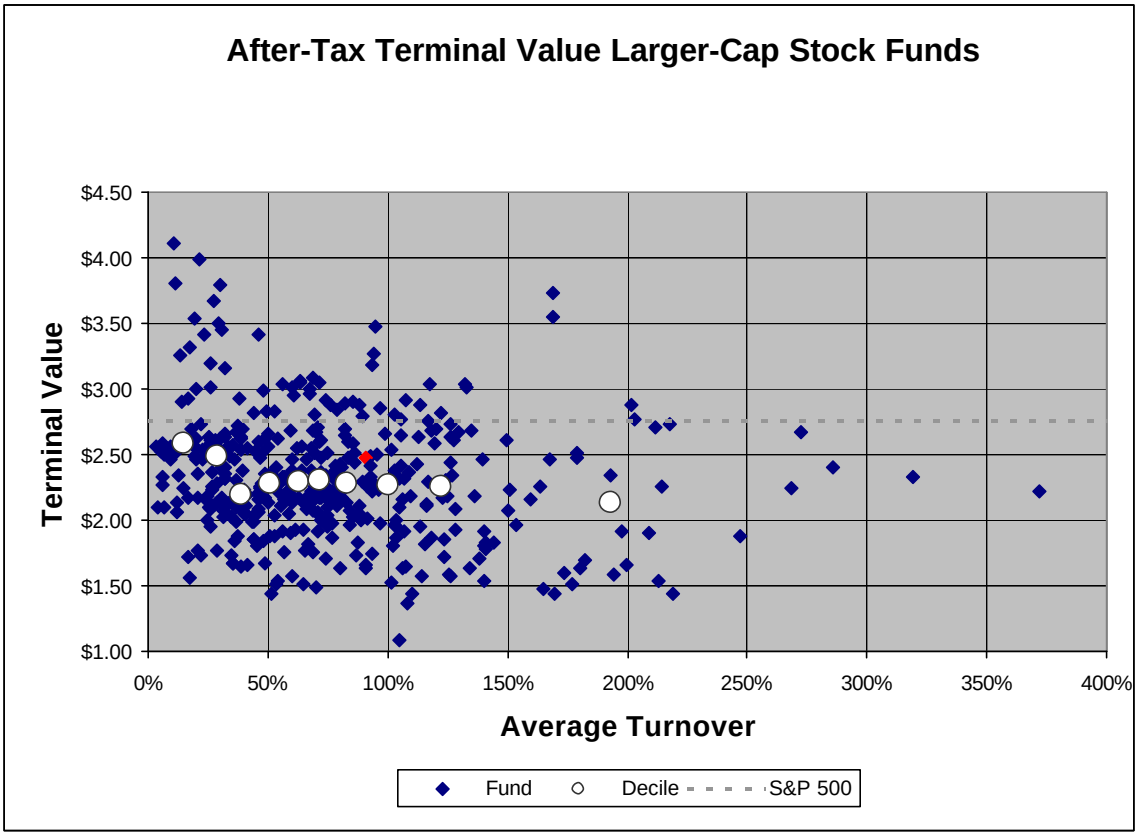


Figure 5

Each small diamond in the scatter plot graph represents one fund. For illustration purposes, the red diamond represents the largest fund in the group (the Fidelity Magellan Fund), which had an average turnover of 92% and an after-tax terminal value of $2.47. (I.e. $1 invested in the fund on December 31, 1991 would have been worth $2.47 on December 31,2001, after deducting all taxes, including liquidating capital gains taxes. This ignores any front-end or back-end loads that might have applied). The dotted line shows the hypothetical after-tax terminal value of the S&P 500, at $2.76. We see that there is a wide range of outcomes. However, when we rank and group funds by turnover, a pattern emerges. The 10% of the Larger-Cap funds with the lowest turnover had, as a group, an average turnover of 15% and an average after-tax terminal value of $2.59. On the other hand, the 10% of the Larger-Cap funds with the *highest* turnover had an average turnover of 193% and an average terminal value of $2.14. The 10 *Deciles* of funds ranked by turnover are represented in the graph by the larger white circles. The conclusion is that lower turnover Larger-Cap funds on average, offered higher after-tax returns than higher turnover funds.

Smaller-Cap U.S. Equity Funds

Decile	Mean Avg. Ann. Turnover	Max Avg. Ann. Turnover	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax
1	20%	26%	$3.45	$2.64	13.2%	10.2%
2	32%	37%	$3.55	$2.70	13.5%	10.4%
3	47%	52%	$3.25	$2.48	12.5%	9.5%
4	60%	66%	$3.01	$2.38	11.6%	9.1%
5	72%	81%	$3.26	$2.52	12.5%	9.7%
6	85%	89%	$2.86	$2.27	11.1%	8.5%
7	98%	102%	$2.84	$2.26	11.0%	8.5%
8	110%	116%	$2.80	$2.24	10.8%	8.4%
9	129%	145%	$2.87	$2.29	11.1%	8.6%
10	210%	535%	$2.42	$2.01	9.2%	7.2%
All	85%	535%	$3.04	$2.38	11.8%	9.1%
Low/High Advantage			43%	31%		

Table 6

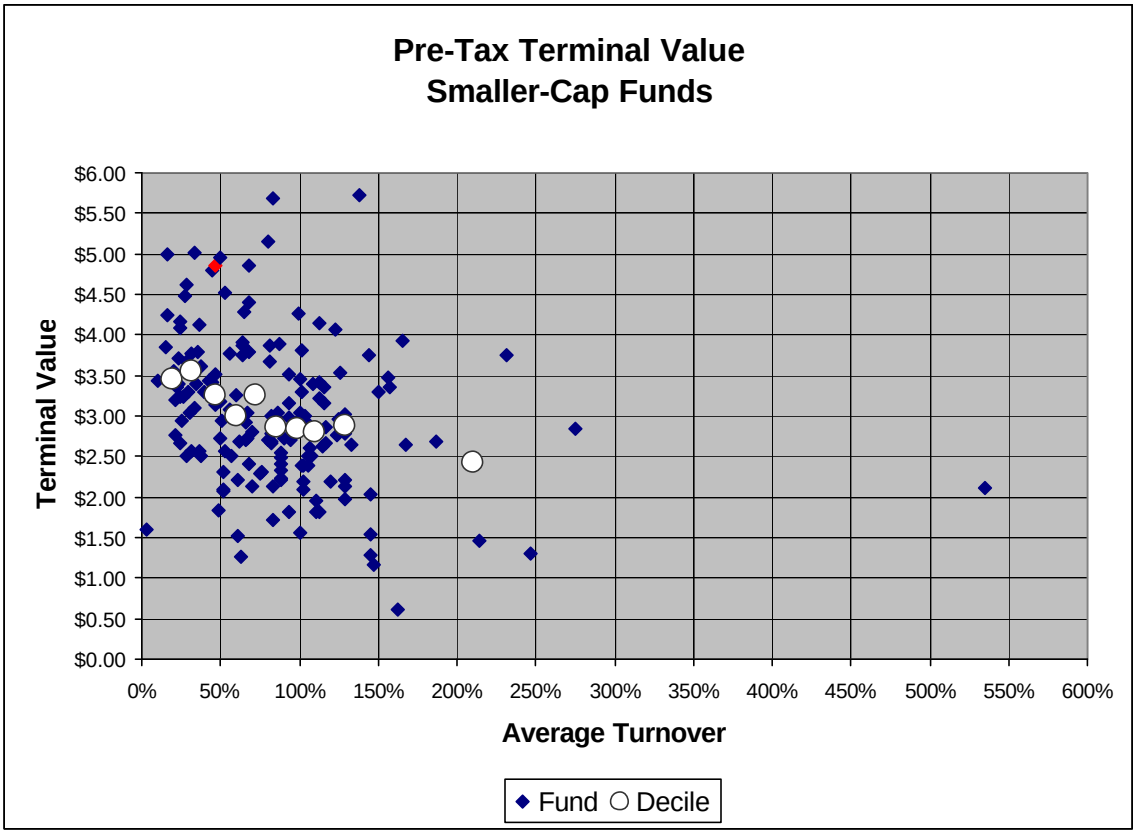


Figure 6

Each small diamond in the Figure 6 represents one fund. For illustration purposes, the red diamond represents the largest fund in the group (the Fidelity Low-Priced Stock Fund), which had an average turnover of 50% and a pre-tax terminal value of $4.94. (This ignores any front-end or back-end loads that might have applied). We see that there is a wide range of outcomes. However, when we rank and group funds by turnover, a pattern emerges. The 10% of the Smaller-Cap funds with the lowest turnover had, as a group, an average turnover of 20% and an average terminal value of $3.45. On the other hand, the 10% of the Smaller-Cap funds with the *highest* turnover had an average turnover of 210% and an average terminal value of $2.42. The 10 *Deciles* of funds ranked by turnover are represented in the graph by the larger white circles. The conclusion is that lower turnover Smaller-Cap funds on average, offered higher pre-tax returns than higher turnover funds.

International Funds

Decile	Mean Avg. Ann. Turnover	Max Avg. Ann. Turnover	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax
1	19%	24%	$2.31	$1.89	8.7%	6.6%
2	30%	33%	$2.41	$1.94	9.2%	6.9%
3	39%	45%	$1.92	$1.66	6.7%	5.2%
4	51%	56%	$1.87	$1.62	6.5%	4.9%
5	60%	63%	$1.89	$1.66	6.6%	5.2%
6	69%	72%	$1.88	$1.62	6.5%	4.9%
7	81%	87%	$2.02	$1.73	7.3%	5.6%
8	100%	104%	$1.99	$1.71	7.1%	5.5%
9	112%	123%	$1.85	$1.62	6.3%	4.9%
10	154%	184%	$1.86	$1.63	6.4%	5.0%
All	71%	184%	$2.01	$1.71	7.2%	5.5%
Low/High Advantage			24%	16%		

Table 7

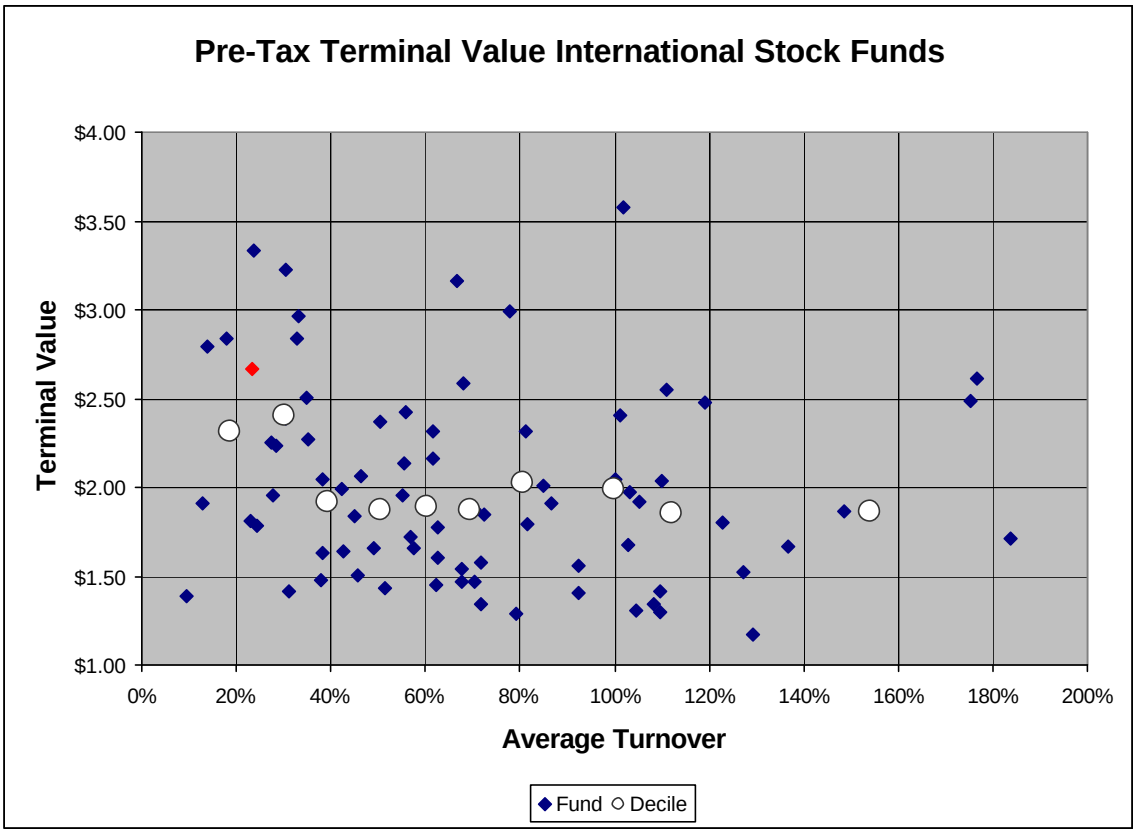


Figure 7

Each small diamond in the scatter plot graph represents one fund. For illustration purposes, the red diamond represents the largest fund in the group (the EuroPacific Growth Fund), which had an average turnover of 23% and a pre-tax terminal value of $2.67. (I.e. $1 invested in the fund on December 31, 1991 would have been worth $2.67 on December 31, 2001, ignoring all tax consequences. This also ignores any front-end or back-end loads that might have applied). We see that there is a wide range of outcomes. However, when we rank and group funds by turnover, a pattern emerges. The 10% of the International funds with the lowest turnover had, as a group, an average turnover of 19% and an average terminal value of $2.31. On the other hand, the 10% of the International funds with the *highest* turnover had an average turnover of 154% and an average terminal value of $1.86. The 10 *Deciles* of funds ranked by turnover are represented in the graph by the larger white circles. The conclusion is that lower turnover International funds on average, offered higher pre-tax returns than higher turnover funds.

Municipal Bond Funds

Decile	Mean Avg. Ann. Turnover	Max Avg. Ann. Turnover	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax
1	12%	14%	$1.75	$1.73	5.8%	5.6%
2	16%	19%	$1.73	$1.72	5.6%	5.6%
3	21%	23%	$1.75	$1.74	5.8%	5.7%
4	25%	28%	$1.75	$1.74	5.8%	5.7%
5	30%	32%	$1.76	$1.74	5.8%	5.7%
6	35%	38%	$1.76	$1.74	5.8%	5.7%
7	41%	44%	$1.75	$1.73	5.8%	5.6%
8	50%	57%	$1.74	$1.73	5.7%	5.6%
9	67%	80%	$1.71	$1.70	5.5%	5.4%
10	127%	488%	$1.69	$1.68	5.4%	5.3%
All	42%	488%	$1.74	$1.72	5.7%	5.6%
Low/High Advantage			4%	3%		

Table 8

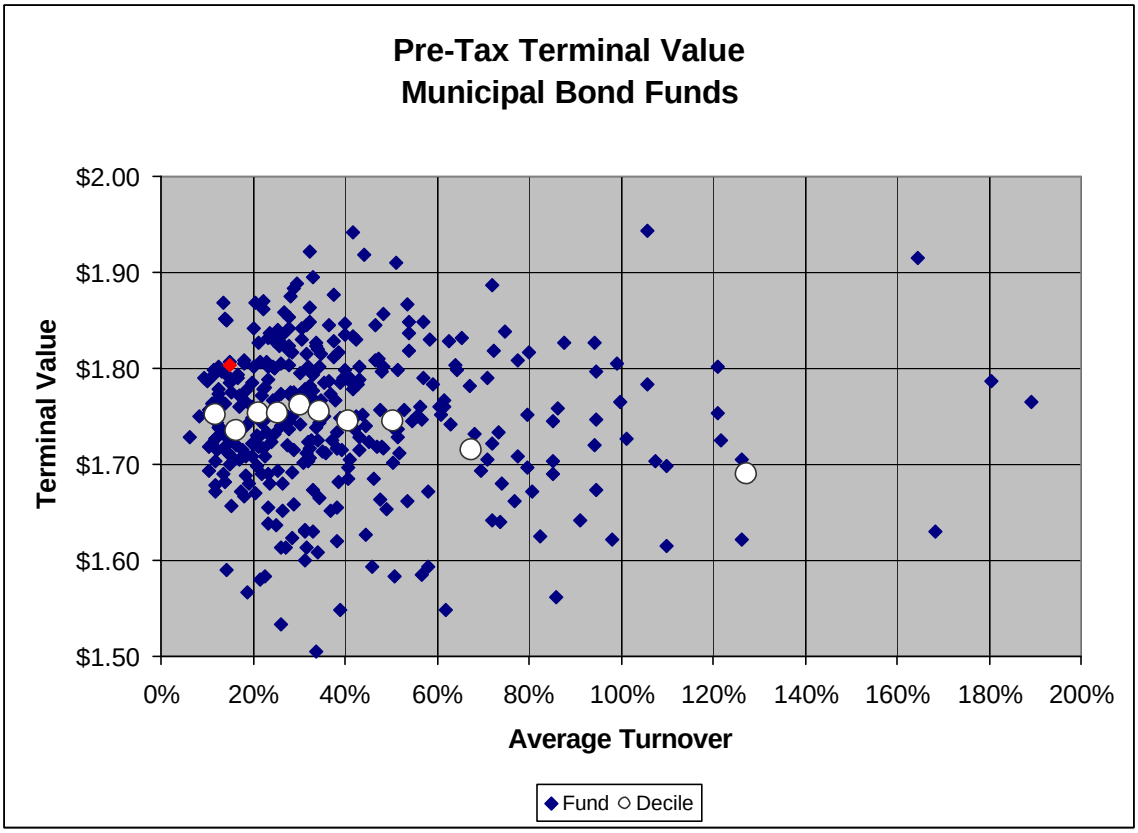


Figure 8 (A small number of the highest-turnover, lowest performance outliers were omitted from the above graph)

Each small diamond in the graph represents one fund. For illustration purposes, the red diamond represents the largest fund in the group (the Franklin California Tax-Free Income Fund), which had an average turnover of 15% and a pre-tax terminal value of $1.80. (I.e. $1 invested in the fund on December 31, 1991 would have been worth $1.80 on December 31, 2001, ignoring all tax consequences. This also ignores any front-end or back-end loads that might have applied). The 10% of the Municipal Bond funds with the lowest turnover had, as a group, an average turnover of 12% and an average terminal value of $2.31. On the other hand, the 10% of the International funds with the *highest* turnover had an average turnover of 127% and an average terminal value of $1.69 The conclusion is that lower turnover Municipal funds on average, offered higher pre-tax returns than higher turnover funds.

Outcomes by Expense Ratio

The following tables are similar to the corresponding tables in the Turnover section, except they are organized by Expense Ratio.

Larger-Cap U.S. Equity Funds

Decile	Mean Expense Ratio	Max Expense Ratio	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax	S&P 500 Beaters Pre-Tax	S&P 500 Beaters After-Tax
S&P 500			$3.38	$2.76	13.0%	10.7%		
1	0.48%	0.65%	$3.29	$2.50	12.7%	9.6%	49%	17%
2	0.72%	0.77%	$3.15	$2.43	12.2%	9.3%	41%	22%
3	0.82%	0.86%	$2.88	$2.26	11.2%	8.5%	10%	5%
4	0.91%	0.95%	$3.02	$2.34	11.7%	8.9%	23%	9%
5	0.99%	1.03%	$2.97	$2.34	11.5%	8.9%	24%	14%
6	1.07%	1.10%	$2.89	$2.28	11.2%	8.6%	28%	15%
7	1.15%	1.21%	$2.85	$2.26	11.0%	8.5%	14%	14%
8	1.27%	1.35%	$2.93	$2.30	11.4%	8.7%	23%	18%
9	1.44%	1.59%	$2.85	$2.26	11.0%	8.5%	21%	17%
10	1.91%	3.63%	$2.60	$2.10	10.0%	7.7%	15%	7%
All	1.07%	3.63%	$2.94	$2.31	11.1%	8.5%	25%	14%
Low/High Advantage			26%	19%				

Table 9

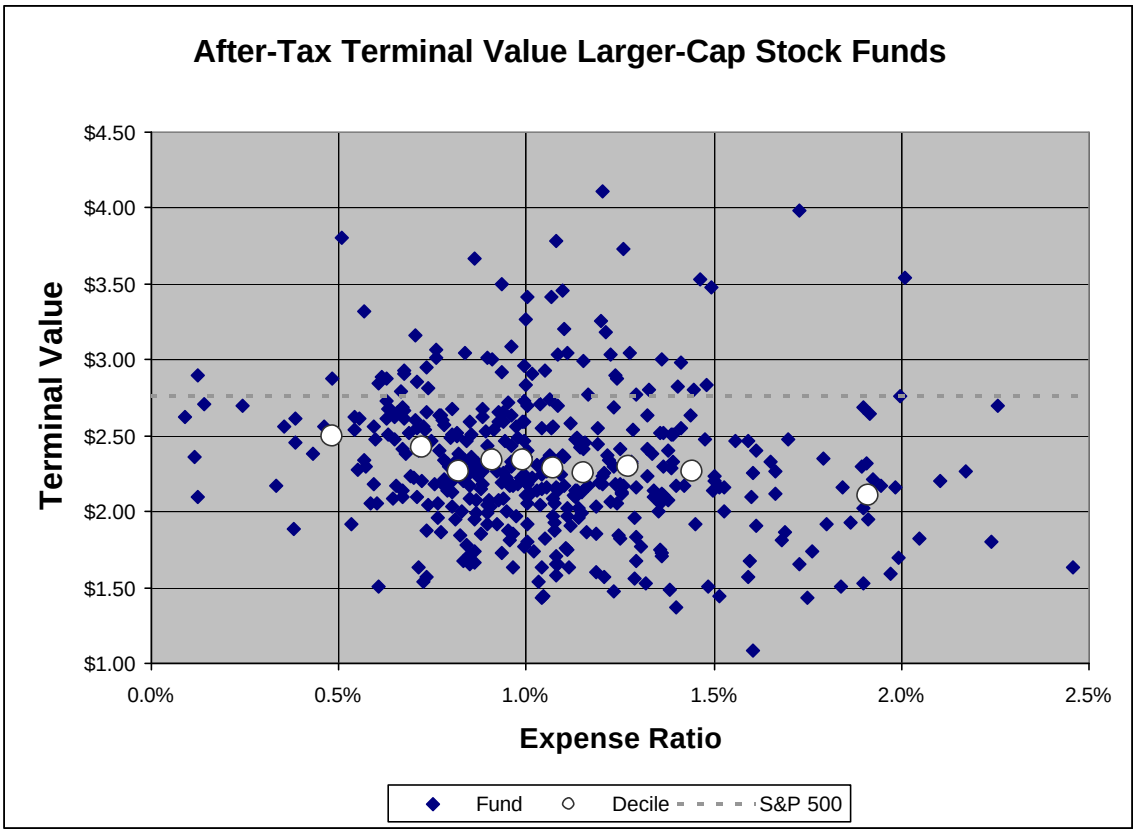


Figure 9

The above graph plots the relationship between expense ratio and after-tax terminal value for Larger-Cap funds. Each diamond represents one fund; each white circle represents a Decile (10%) of funds ranked by expense ratio. For example, the Decile of the funds with the lowest expense ratio had an average expense ratio of 0.48% and an after-tax terminal value of $2.50. On the other hand, the Decile of the funds with the highest expense ratio had an average expense ratio of 1.91% and an average after-tax terminal value of $2.10.

Distribution of Larger-Cap Funds Relative to the S&P 500

The following table shows the distribution of Larger-Cap funds relative to the S&P500 on an after-tax basis. For example, out of the 415 funds in the sample, 97 (23.4% of the total) had average annual after-tax returns that were between 2% and 3% *below* the average annual after-tax return of the S&P 500. On the other hand, only 8 funds (1.9% of the total) *beat* the S&P 500 by a margin of 2% - 3%. (A graph representing this table (Figure 2) is on page 4)

Performance range	Number of Funds	Percentage
-12% ..-11%	1	0.2%
-11% ..-10%	0	0.0%
-10%.. -9%	1	0.2%
-9% .. -8%	0	0.0%
-8% .. -7%	2	0.5%
-7% .. -6%	16	3.9%
-6% .. -5%	24	5.8%
-5% .. -4%	29	7.0%
-4% .. -3%	52	12.5%
-3% .. -2%	97	23.4%
-2% .. -1%	74	17.8%
-1% .. 0%	62	14.9%
0% .. 1%	31	7.5%
1% .. 2%	12	2.9%
2% .. 3%	8	1.9%
3% .. 4%	4	1.0%
4% .. 5%	2	0.5%
Total	**415**	**100%**

Table 10

The table below shows how different various types of Larger-Cap funds fared relative to the S&P 500 on an after-tax basis. (A graph representing this table (Figure 3) is on page 5)

For example, 6.3% of all Larger-Cap funds beat the tax-adjusted S&P500 by more than 1% per year. The tallest yellow bar shows that 85.4% of the highest-expense funds (Decile 10) lagged the S&P500 by more than 1% per year. On the other hand, the lowest-expense funds (Decile 1) had the lowest odds (46.3%) of significantly underperforming the S&P 500.

Performance Relative to S&P 500		Lowest Expense	Lowest Turnover	All	Highest Turnover	Highest Expense
< -1%	significant underperformance	46.3%	52.4%	71.3%	80.5%	85.4%
-1 – 0%	modest underperformance	36.6%	23.8%	14.9%	9.8%	7.3%
0 - 1%	modest outperformance	12.2%	7.1%	7.5%	4.9%	2.4%
> 1%	significant outperformance	4.9%	16.7%	6.3%	4.9%	4.9%

Table 11

In a nutshell, if you pick a high-turnover or a high-expense fund, you have very good odds of lagging the S&P 500 by a significant amount, and very poor odds of decisively beating the S&P 500. On the other hand, if you pick a low-expense or low-turnover fund, your odds of decisively beating the S&P 500 are a little better, and you have significantly better odds of avoiding a disaster.

Smaller-Cap U.S. Equity Funds

Decile	Mean Expense Ratio	Max Expense Ratio	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax
1	0.57%	0.76%	$2.97	$2.38	11.5%	9.1%
2	0.86%	0.92%	$3.03	$2.45	11.7%	9.4%
3	0.96%	1.00%	$2.86	$2.33	11.1%	8.8%
4	1.03%	1.06%	$3.05	$2.44	11.8%	9.3%
5	1.13%	1.18%	$3.43	$2.65	13.1%	10.3%
6	1.22%	1.26%	$3.00	$2.43	11.6%	9.3%
7	1.30%	1.35%	$2.61	$2.23	10.1%	8.3%
8	1.42%	1.48%	$3.04	$2.50	11.8%	9.6%
9	1.62%	1.81%	$2.57	$2.15	9.9%	7.9%
10	2.10%	2.62%	$2.56	$2.27	9.9%	8.5%
All	1.21%	2.62%	$3.04	$2.38	11.8%	9.1%
Low/High Advantage			16%	5%		

Table 12

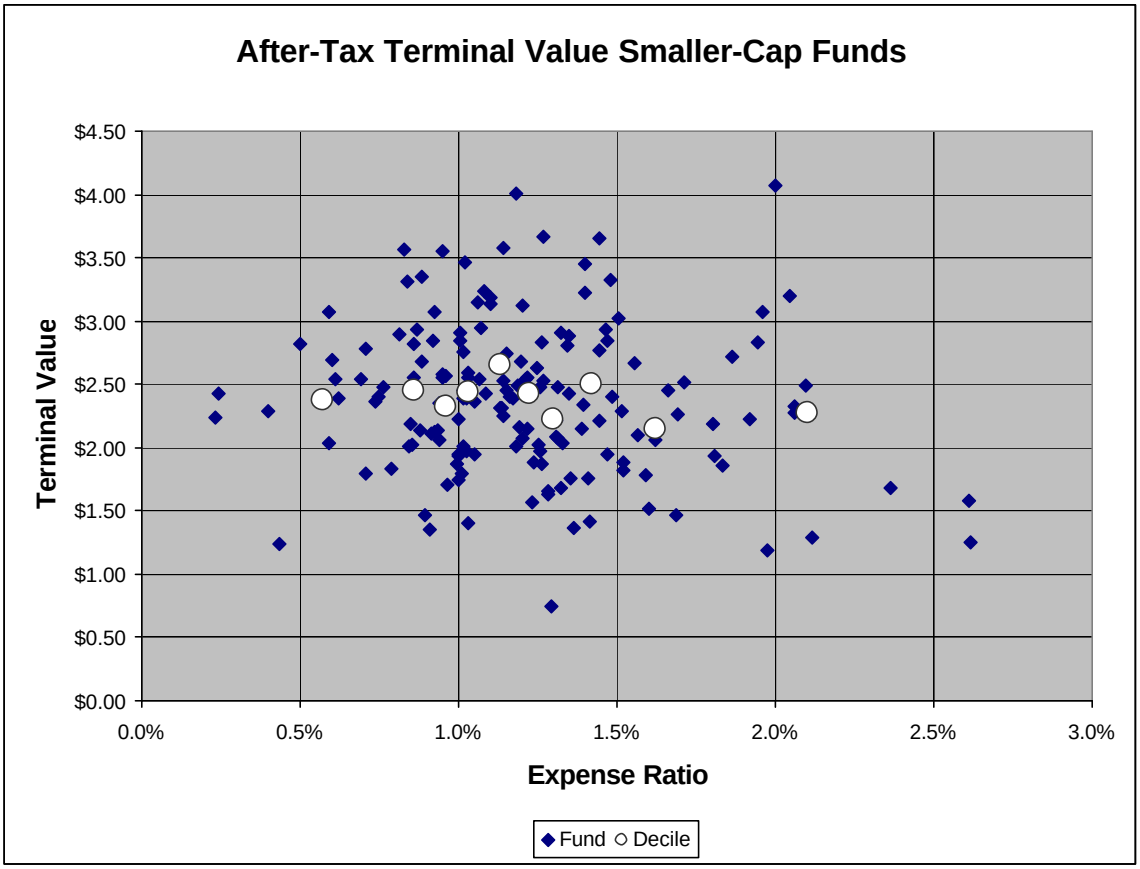


Figure 10

The above graph plots the relationship between expense ratio and after-tax terminal value for Smaller-Cap funds. Each diamond represents one fund, each white circle represents a Decile (10%) of funds ranked by expense ratio. For example, the Decile of the funds with the lowest expense ratio had an average expense ratio of 0.57% and an after-tax terminal value of $2.38. On the other hand, the Decile of the funds with the highest expense ratio had an average expense ratio of 2.62% and an average after-tax terminal value of $2.27. The relationship between expense ratio and after-tax terminal value for Smaller-Cap funds does not appear to be as strong as it is for other types of funds.

International Funds

Decile	Mean Expense Ratio	Max Expense Ratio	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax
1	0.58%	0.85%	$2.20	$1.81	8.2%	6.1%
2	0.92%	0.99%	$2.26	$1.88	8.5%	6.5%
3	1.05%	1.12%	$2.41	$1.93	9.2%	6.8%
4	1.17%	1.21%	$2.17	$1.81	8.1%	6.1%
5	1.26%	1.32%	$2.00	$1.73	7.2%	5.6%
6	1.37%	1.41%	$1.93	$1.68	6.8%	5.3%
7	1.46%	1.58%	$1.83	$1.62	6.2%	4.9%
8	1.67%	1.71%	$1.72	$1.49	5.6%	4.1%
9	1.85%	2.06%	$1.82	$1.60	6.2%	4.8%
10	2.34%	2.48%	$1.68	$1.50	5.3%	4.2%
All	1.35%	2.48%	$2.01	$1.71	7.2%	5.5%
Low/High Advantage			31%	21%		

Table 13

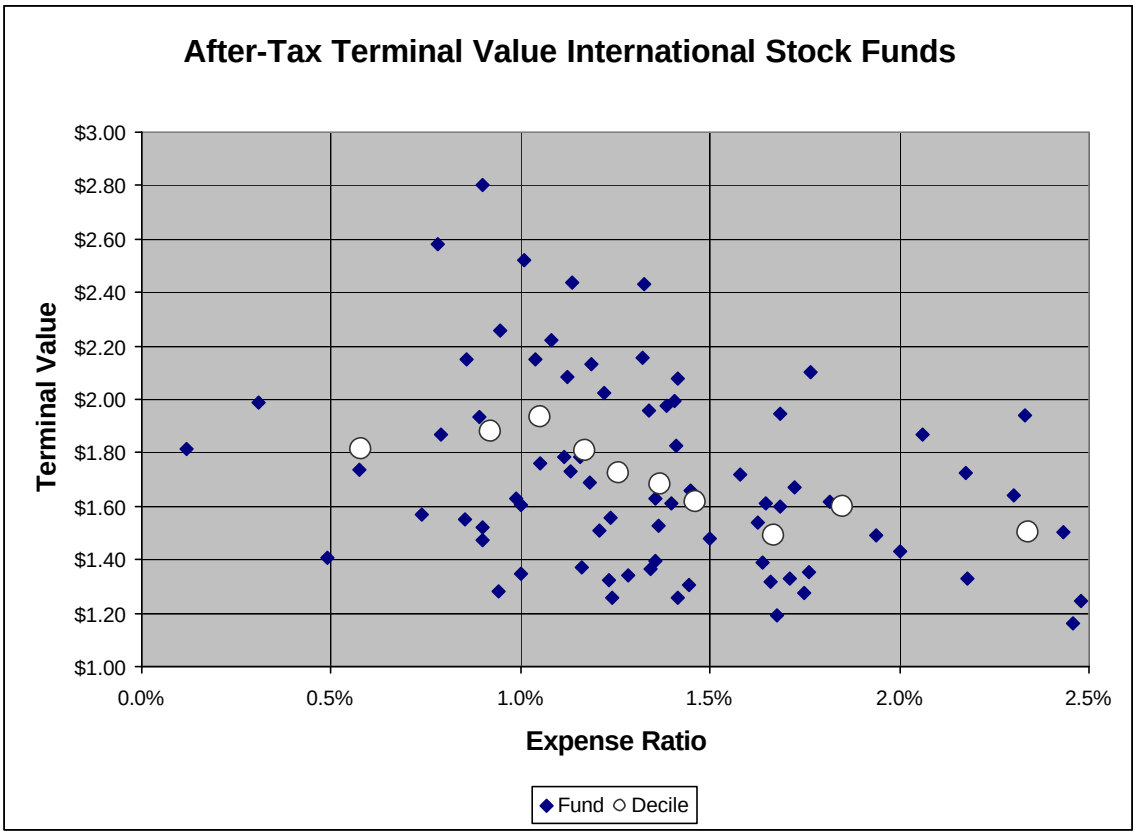


Figure 11

The above graph plots the relationship between expense ratio and after-tax terminal value for International funds. Each diamond represents one fund, each white circle represents a Decile (10%) of funds ranked by expense ratio. For example, the Decile of the funds with the lowest expense ratio had an average expense ratio of 0.58% and an after-tax terminal value of $1.81. On the other hand, the Decile of the funds with the highest expense ratio had an average expense ratio of 2.34% and an average after-tax terminal value of $1.50. The conclusion is that lower expense International funds on average, offered higher after-tax returns than higher expense funds.

Government Bond Funds

Decile	Mean Expense Ratio	Max Expense Ratio	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax
1	0.43%	0.60%	$1.97	$1.49	7.0%	4.1%
2	0.63%	0.67%	$1.91	$1.47	6.7%	3.9%
3	0.75%	0.80%	$1.87	$1.45	6.5%	3.8%
4	0.83%	0.85%	$1.87	$1.47	6.4%	3.9%
5	0.88%	0.91%	$1.88	$1.46	6.5%	3.9%
6	0.94%	0.96%	$1.80	$1.40	6.0%	3.4%
7	1.00%	1.03%	$1.79	$1.41	6.0%	3.5%
8	1.07%	1.14%	$1.78	$1.39	5.9%	3.3%
9	1.29%	1.43%	$1.73	$1.37	5.6%	3.2%
10	1.85%	2.26%	$1.67	$1.34	5.3%	2.9%
All	0.96%	2.26%	$1.82	$1.42	6.2%	3.6%
Low/High Advantage			18%	12%		

Table 14

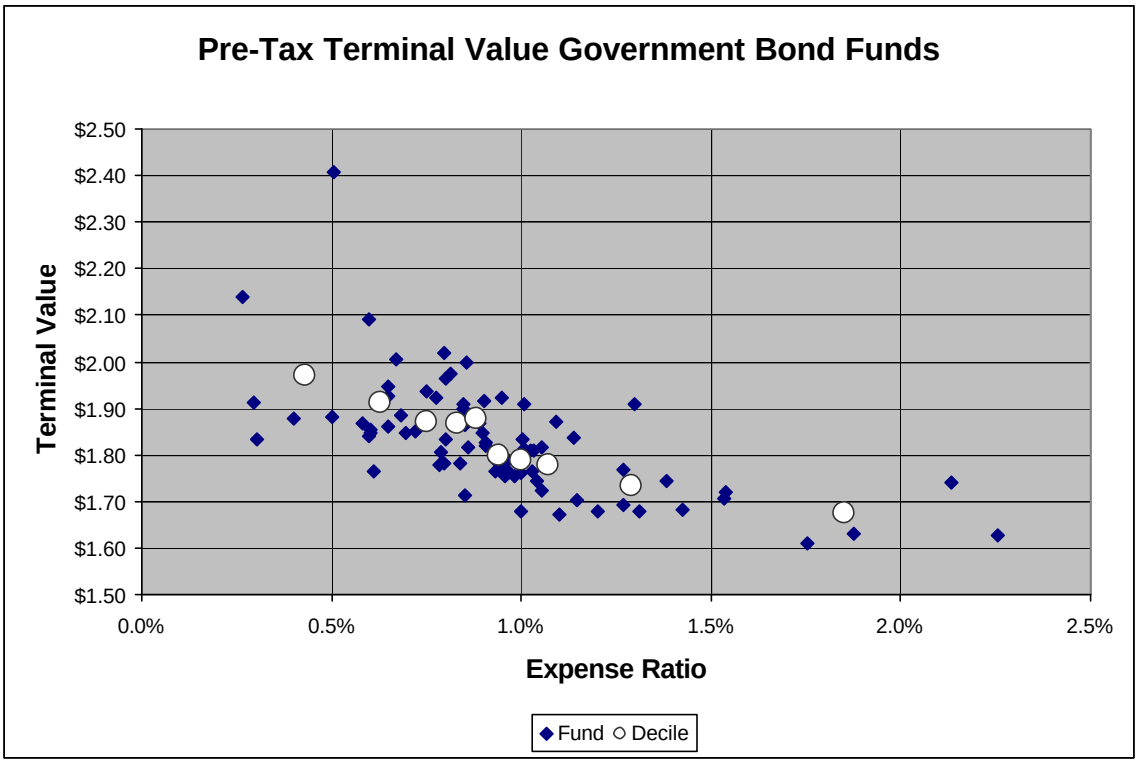


Figure 12

The above graph plots the relationship between expense ratio and pre-tax terminal value for Government Bond funds. Each diamond represents one fund, each white circle represents a Decile (10%) of funds ranked by expense ratio. For example, the Decile of the funds with the lowest expense ratio had an average expense ratio of 0.43% and an after-tax terminal value of $1.97. On the other hand, the Decile of the funds with the highest expense ratio had an average expense ratio of 1.85% and an average after-tax terminal value of $1.67. The conclusion is that lower expense Government Bond funds on average, offered higher after-tax returns than higher expense funds.

Municipal Bond Funds

Decile	Mean Expense Ratio	Max Expense Ratio	Average Terminal Value Pre-Tax	Average Terminal Value After-Tax	Average Annual Return Pre-Tax	Average Annual Return After-Tax
1	0.43%	0.55%	$1.79	$1.76	6.0%	5.8%
2	0.62%	0.66%	$1.78	$1.77	6.0%	5.8%
3	0.69%	0.72%	$1.78	$1.76	5.9%	5.8%
4	0.74%	0.76%	$1.76	$1.75	5.8%	5.7%
5	0.79%	0.81%	$1.76	$1.74	5.8%	5.7%
6	0.84%	0.86%	$1.75	$1.74	5.8%	5.7%
7	0.89%	0.91%	$1.75	$1.73	5.7%	5.6%
8	0.94%	0.97%	$1.73	$1.73	5.7%	5.6%
9	1.06%	1.18%	$1.71	$1.69	5.5%	5.4%
10	1.54%	3.36%	$1.56	$1.59	4.5%	4.7%
All	0.85%	3.36%	$1.74	$1.72	5.7%	5.6%
Low/High Advantage			15%	11%		

Table 15

(Note that the after-tax value of the Decile 10 funds is slightly higher than their pre-tax value. This is attributable to capital-loss tax credits)

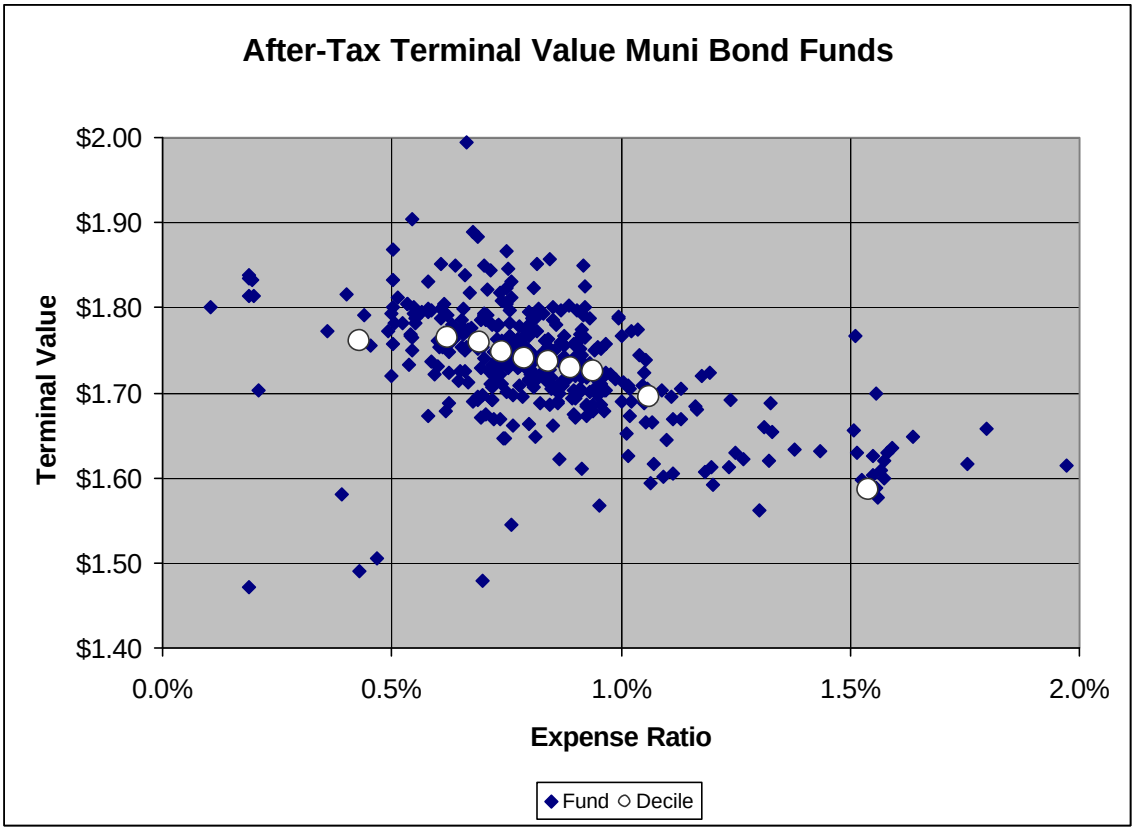


Figure 13

(A small number of the highest-expense, lowest performance outliers were omitted from the above graph)

The above graph plots the relationship between expense ratio and after-tax terminal value for Municipal Bond funds. Each diamond represents one fund, each white circle represents a Decile (10%) of funds ranked by expense ratio. For example, the Decile of the funds with the lowest expense ratio had an average expense ratio of 0.43% and an after-tax terminal value of $1.76. On the other hand, the Decile of the funds with the highest expense ratio had an average expense ratio of 154% and an average after-tax terminal value of $1.59. The conclusion is that lower expense Municipal Bond funds on average, offered higher after-tax returns than higher expense funds.

Appendix A. Turnover and Transaction Costs

The table summarizes various studies of mutual fund turnover and/or institutional transaction costs. Each study defines its own cross-sections for dividing the universe of U.S. equities. Each number in the table represents the cost of a round-trip transaction, or the expected reduction in a fund's annual pre-tax return per 100% of fund turnover.

Asset Class/Style	Personal Fund	Carhart [3]	Plexus [8]	VIP Forum [9]	Keim/Madhavan [10] (NYSE/AmEX)	Keim/Madhavan (NASDAQ)	Chakravarty [11]
U.S. Equity							
Average U.S. Equity		0.95%			1.04%	2.66%	
Large Cap	1.24%		2.02%	0.66%			
Mid Cap	2.55%		8.98%	1.15%			
Small Cap	2.55%		8.98%	3.59%			
Large Value			1.30%				
Large Growth			3.18%				
Small Value			3.36%				
Small Growth			6.24%				
Value					0.38%	0.98%	
Index	1.19%		2.76%		0.75%	2.06%	
Technical					1.58%	3.07%	
International Equity	1.54%						
Municipal Bond	0.43%						0.23%
U.S. Government Bond	0.09%						0.08%
Corporate Bond							0.21%

Table 16

For Further Information

Our website, at http://www.personalfund.com/ contains up-to-date information on the costs (including relative cost and turnover rankings), tax efficiency and historical after-tax returns for over 13,000 mutual funds.

Endnotes and References

[1] Ibbotson Associates, "Stocks, Bonds, Bills and Inflation 1998 Yearbook"; Supplemental data from Lipper, Inc.
[2] LANA Fund Classifications. http://www.lipperweb.com/usa/services/def/class.shtml
[3] Carhart, Mark "On Persistence in Mutual Fund Performance", *Journal of Finance*, March 1997
[4] Malkiel, Burton "Returns from Investing in Equity Mutual Funds 1971-1991", *Journal of Finance*, June 1995
Jensen, Michael, "Problems in the Selection of Security Portfolios: The Performance of Mutual Funds in the Period 1945-1964", *Journal of Finance* May 1968
[5] http://www.barra.com/research/summary_returns.asp
[6] Income distributions for municipal bond funds are treated as exempt from all taxes. Income distributions for U.S. government bond funds are exempt from state, but not federal taxes.
[7] Rounded to the nearest whole number. Also, all funds with the same turnover are always placed in the same Decile. e.g. in a Category of 618 funds, various Deciles may have 60, 61, 62 or 63 members, etc.
[8] The Plexus Group, "How Manager Style Influences Cost", May 1998; "The Official Icebergs of Transaction Costs", January 1998; "Costs by Market Cap: The Cost of International Liquidity", April 2000 http://www.plexusgroup.com/fs_research.html
[9] The VIP Forum of the Corporate Executive Board, "Redefining Performance: Building the Sustainable Investment Management Business", 1999, p.17; available at http://www.thevipforum.com/guest/VIP/redef_performance.pdf
[10] Keim, Donald and Ananth Madhavan, "Transactions Costs and Investment Style: An Inter-Exchange Analysis of Institutional Equity Trades, *Journal of Financial Economics* 46, 1997
[11] Chakravarty, Sugato and Asani Sarkar, "Liquidity in U.S. Fixed Income Markets: A Comparison of the Bid-Ask Spread in Corporate, Government and Municipal Bond Markets", Federal Reserve Bank of New York, March 1999

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