# Testing Market Efficiency for Different Market Capitalization Funds

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## Abstract

The main purpose of this study is to use the Sharpe Ratio to test the efficient market hypothesis for different market capitalization and investment styles of mutual funds. The results of the study for the entire period of 1994-2007 as well as the two sub-periods (1994-1999 and 2000-2007) indicate that small cap funds have provided the highest risk-adjusted return for the entire period whereas growth funds have exhibited lower returns. The findings, therefore, suggest that the mutual funds market is not always efficient, which makes it possible for an investor or a mutual fund manger to earn excess return on a risk-adjusted basis.

## Introduction

Every investor tries to beat the market by achieving returns on the portfolio that are higher than those achieved by the overall stock market. Normally, investors who have highly diversified portfolios earn returns that are very close to the average of the stock markets over the long run. Given the inherent risk of investing in equities, it is possible for investors to achieve unexpectedly high returns or lose everything on a year-to-year basis. To minimize such fluctuations, individuals and institutional investors rely on mutual funds to diversify their holdings, although it is unclear whether any type of mutual fund would outperform the market.

This paper is primarily concerned with whether it is possible to beat the market by choosing mutual funds based on their market capitalization or by the type of investment objectives they pursue. The objective of this paper is to find if the large, medium and small capitalized mutual funds earn equal returns on the risk-adjusted basis. Furthermore, the study will examine the efficiency of mutual funds based on their broad objectives (growth, value and blend).

## Can investors beat the market by choosing mutual funds based on their market capitalization?

The paper is organized in the following format. The first section gives a general introduction to mutual funds followed by a review of literature and then a discussion of the methodology and data. The empirical results are presented and conclusions and implications for investors are discussed in the final section.

## Mutual Funds

Mutual funds are one form of investment that consists of stocks, bonds, other securities or any combination of financial instruments. The primary goal of mutual funds is diversification, which would allow the investor to significantly reduce, or even eliminate, the non-market risk of securities. Therefore, the major risk of a mutual fund is the market risk. However, a well-diversified portfolio consisting of mutual funds, including international funds, may even reduce market risk because of the relatively low correlation among the movements of world's stock markets.

Stock funds can be divided into three major categories based on their market capitalization: large, medium, and small-cap funds. Market capitalization is determined as the market value of outstanding shares and is computed by multiplying the price per share by the number of outstanding shares. There are no precise rules about categorizing companies. According to Motley Fool, an Internet investment guide, over $5 billion of market capital is considered large-cap, between $500 million and $5

billion–mid-cap, from $150 million and $500 million–small-cap, and micro-cap if lower than $150 million.[1] Large market capitalization does not mean that the funds invest only in large companies; it is the average of the capitalization values for all stocks held in the fund. Therefore, the value of market capitalization helps to determine whether the fund invests primarily in large, medium, or small size companies. But even within these categories, Morningstar distinguishes more conservative value funds from aggressive growth funds, or a blend of both— a combination of growth and income investing styles.

Historically, small-cap funds tended to produce higher annual returns than large-cap funds while returns of mid-cap funds fell somewhere in the middle. One would think that investing in small-caps would result in the highest returns. In reality, this is not always the case because of the higher risk associated with small-cap stocks. During the "bull" market, small caps are normally the winners. Still, it is more difficult for small companies to finance projects and it is easier to go bankrupt. As a result, their stocks are more volatile, which means that during the "bear" market small-caps are the losers. Because of wider price swings and resulting higher fluctuations in their returns, the standard deviation of small-cap funds tends to be much higher than that of large-cap funds, which means that small-caps are riskier than mid-caps and large-cap funds are the least risky of the three. Table 1 reports the average returns on mutual funds as of September 28, 2007.

These returns are further illustrated in Figure 1, showing the range of average annual returns of large, medium, and small-cap mutual funds in up and down market years for the 1976–1999 period of time. The larger range in returns indicates the greater volatility of the fund category on both the upside and downside. The performance of large-cap stocks was measured by S&P 500 Index; medium size stocks' returns were based on S&P MidCap 400 Index; and

| Table 1 — Returns of Mutual Funds (%) | | | | |
|---|---|---|---|---|
| | YTD | 1-Year Returns | 3-Year Returns | 5-Year Returns |
| Large Value | 6.83 | 14.50 | 13.54 | 16.15 |
| Large Blend | 9.19 | 16.52 | 13.09 | 14.76 |
| Large Growth | 14.09 | 20.61 | 12.95 | 14.07 |
| Mid Value | 6.43 | 14.75 | 14.13 | 17.98 |
| Mid Blend | 9.13 | 17.52 | 14.73 | 18.18 |
| Mid Growth | 16.46 | 26.23 | 22.08 | 22.50 |
| Small Value | 0.74 | 9.14 | 11.71 | 17.41 |
| Small Blend | 4.61 | 13.54 | 13.50 | 18.24 |
| Small Growth | 11.56 | 20.44 | 14.24 | 17.63 |

Source: Morningstar, September 28, 2007

Dimensional Fund Advisors U.S. Micro Cap Index measured the performance of small capitalization stocks.

## Literature Review

The efficient market hypothesis (EMH) states that investors cannot beat the market because security prices reflect all relevant information. The term "efficient market" was first mentioned by Eugene Fama in 1965. In the efficient market, there are a large number of rational investors who compete with each other trying to predict future prices of individual securities and the important information is freely available to everyone. Therefore, "competition will cause the full effects of new information on intrinsic values to be reflected 'instantaneously' in actual prices" (Fama, 1965). The EMH has significant implications for investors who, according to this hypothesis, cannot systematically outperform the market. The development of the Capital Asset Pricing Model (CAPM) by William Sharpe (1964) and John Lintner (1965) made it possible to test the efficient market theory empirically. The extensive testing of the EMH has yielded mixed results. The research by Fama (1970), Sorensen (1982), Davidson and Froyer (1982), and Pearce and Roley (1983, 1985) provided consistent support for the EMH. Other research-

ers (e.g Flavin 1983, Kleidon 1986) also presented evidence that is consistent with the efficient markets. However, several anomalies of the EMH have been found during subsequent research, including Shiller (1979, 1981) and Rosenberg et al. (1985), among others, who showed that the stock volatility is too large to support the theory. Additionally, the efficient market hypothesis is not favored by investors and mutual fund managers who are always interested in beating the market. But because of the lack of an alternative theory, the efficient market hypothesis remains one of the most important in the field of finance.

A number of studies by Friend, Blume, and Crockett (1970), Sharpe (1966), Jensen (1968), Treynor (1965), and others used the CAPM to illustrate the implications of market efficiency. But when the limitations of the CAPM were identified, the researchers (Roll 1977 and Ross 1976) switched to other models such as the Arbitrate Pricing Model (APM) to explain the risk-return trade-off of investing in equities. Some of the earlier studies on mutual funds showed that mutual funds underperformed market indices (Friend et al. 1970, Sharpe 1966, and Jensen 1968). Sharpe calculated the reward-to-volatility ratios[2] for thirty-four funds for the period 1945-1953 and found

## Figure 1
### Volatility of Stocks, 1976-1999



Source: American Express
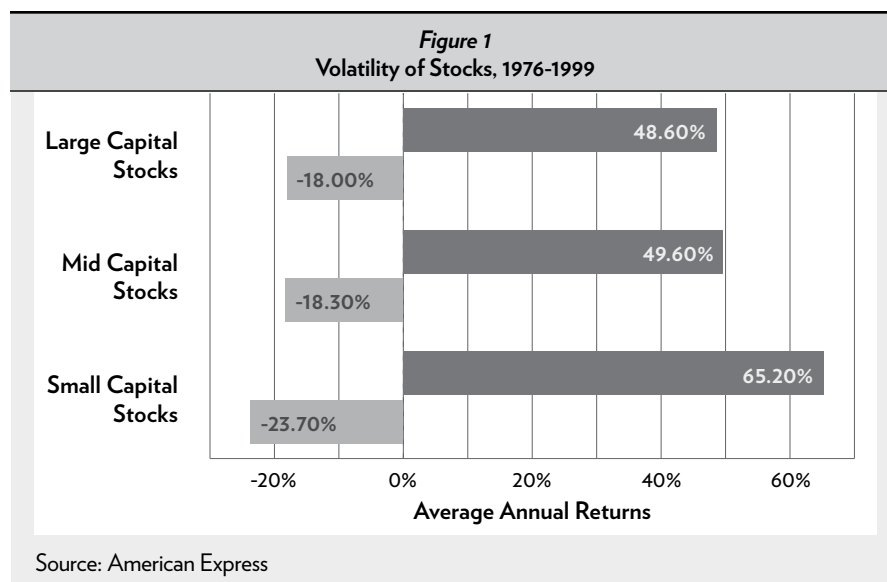
that the ratio for his sample was forty basis points lower than the ratio computed for Dow Jones index for the same period of time. He also compared the ratios across funds based on their investment fees and noticed that funds that had lower expense ratios tended to perform better.

These results were soon confirmed by Jensen (1968) who used the market equation to calculate alphas for his funds and found a statistically significant number of funds with negative alphas. Therefore, both studies by Sharpe and Jensen showed that returns on mutual funds fall short of returns from index funds. However, Carlson (1970) recalculated the Sharpe and Jensen results, emphasizing that the conclusions depend on the time period, type of fund and choice of benchmark. His calculations contradicted both Jensen and Sharpe. The results of the studies by Kon and Jen (1979) and Shawky (1982) were also inconsistent with the Jensen and Sharpe's conclusions. Since the information is hard to collect, the performance of mutual funds that incur costs to collect relevant information is lower than the return of the stock market index (Ippolito 1989). Therefore, the managed funds must earn higher returns sufficient to offset the higher costs of collecting information. The findings of Ippolito (1993) suggested

that mutual funds, on average, are successful in offsetting their expenses. In addition, Grossman and Stiglitz's (1980) results showed that, net of all expenses, mutual funds meet the market rate of return, which supports the efficient market hypothesis.

Many researchers tried to compare the performance of index funds and actively managed funds. Some studies show that index funds outperform managed funds over a long period of time, thus providing support for the EMH (Adrangi and Shank 1999 and Bogle 1994). John Bogle, founder of the first S&P 500 Index mutual fund and a staunch proponent of the low-cost index funds, implies that index funds hold a consistent advantage in risk-adjusted return. He states that "holding risk constant at the level assumed by the funds, the index fund would produce ascending excess annual returns" (Bogle 1999, 157). By basing the comparison of the risk-adjusted returns of the funds on their expense ratios, Bogle found that "high returns are directly associated with low costs" (152). Ippolito (1989), however, found that managed funds, on the risk-adjusted basis, earn rates of return sufficiently high to offset the higher charges. Halpern, Calkins, and Ruggels (1996), Kahn and Rudd (1995) and Bogle (1994) conclude that mutual fund managers could not pos-

sess any other information that is not already included in current stock prices. They suggest that investors will be able to reduce costs by choosing the lowest-cost investment, which is usually index funds (Malkiel 1995). Other studies compared the dartboard portfolio with a professionally selected portfolio and the market indices. For example, the results of a study by Adrangi, Chatrath, and Shank, (2002) show that the performance of the dart portfolio is much lower than that of the market and managed funds. The authors also conclude that, at least in the short-run, mutual fund managers outperform the market, a conclusion that contradicts the EMH.

Very few studies have compared the performance of mutual funds based on their market capitalization. Some researchers find small-cap funds to be less efficient than large-cap funds. For example, John Bogle (1999), using the Sharpe ratio, compared the risk-adjusted returns of the nine Morningstar categories of mutual funds. Morningstar divides each capitalization category into three groups on the basis of the funds investment styles— value, growth, or blend. Bogle found relatively insignificant differences in annual returns and sharp differences in risk among categories, which resulted in lower risk-adjusted returns for more volatile funds. However, within one group, funds in seven of the nine categories (the exceptions are small-cap value and mid-cap growth) had steady risk scores as measured by standard deviation; therefore, the top risk-adjusted returns were earned by the funds with the highest total annual returns.

The question that arises from the results of previous studies is whether the performance of large, medium, and small cap mutual funds on the risk-adjusted basis meets or beats the market. This study will also concentrate on the nine Morningstar categories of mutual funds and compare their risk-adjusted returns. If there were a statistically significant difference in risk-adjusted returns among mutual fund catego-

ries, this would imply that the market is inefficient. If this is true, the study will try to see which group of funds is less efficient than others to determine the implications for investors. On the other hand, if there is no statistically significant difference in risk-adjusted returns, this would support the efficient market hypothesis. The S&P 500 index is selected to represent the market. The choice of this index is based on a number of factors. First, this benchmark is widely used in empirical studies. Second, investors are familiar with this measure. Finally, the S&P index is a viable investment alternative to mutual funds.

## Methodology and Data

### Sharpe Ratio

Among various techniques for computing risk-adjusted return on a stock, the Sharpe ratio is the most widely used. For an investor, it is essential to consider the returns in the context of the fund's risk, the possibility of earning the return that is higher or lower than the expected rate of return. The Sharpe ratio is the principal instrument used by researchers and investors to compare the return per unit of risk. The ratio was first derived by William Sharpe, an economist who received a Nobel Prize for his contribution to the Modern Portfolio Theory. Some researchers emphasize the limitations of the Sharpe ratio, indicating that standard deviation is a very blunt way of measuring risk (Bogle 1999) and gives higher results for funds with non-normal returns, such as hedge funds (Gregoriou and Gueyie 2003). One of the biggest criticisms of the Sharpe ratio is that it measures only historical returns, while it is clear that past performance does not guarantee future results. Although the ratio has several pitfalls, it is the most widely used tool for comparing risk and return. It presents a more complete picture of a fund's performance than the raw return and can help investors to evaluate the relative superiority of similar funds that follow the same investment strategy.

The Sharpe ratio is generally defined as the excess return per unit of risk and is calculated by the following formula:

$$\text{Sharpe ratio} = (R_S - R_{RF}) / \sigma_S$$

where $R_S$ is the average annual return on the fund.

$R_{RF}$ is the risk-free rate of return, normally the annual yield on the 90-day Treasury bill.

$\sigma_S$ is the annualized standard deviation for the fund.

The obvious advantage of the Sharpe ratio is its simplicity, as this is what makes it very popular among researchers. According to Morningstar, the Sharpe ratio of above 1.0 is considered very good, while outstanding funds achieve a ratio of 2.0 or more. A positive Sharpe ratio implies that the fund performed better than the treasury security, and a negative Sharpe ratio implies exactly the opposite.

The assumption that the returns on mutual funds have normal distributions, i.e. are fully described by their mean and standard deviation, is essential for the validity of the Sharpe ratio. If this is not the case, it cannot be an appropriate performance measure because it is sensitive to the skewness and abnormal returns.

### Modigliani and Modigliani (M-Squared) Measure

An alternative method of measuring the risk-adjusted performance of mutual funds was developed by Nobel Laureate Franco Modigliani and her granddaughter, Leah Modigliani (1997), and is commonly referred to as the M-squared measure. The main distinction between this measure and the Sharpe ratio is that the M-squared measure calculates the performance of a portfolio in the traditional unit of measurements for portfolios, allowing an easy way to compare the returns of a portfolio with the overall market index[3].

$$\text{M-squared=} [(R_S - R_{RF}) / \sigma_S] \sigma_M + R_{RF}$$

### Table 2
#### Annual Risk and Return of Mutual Funds 1994-2007

| | Value | Blend | Growth |
|---|---|---|---|
| **Large** Return | 12.17 | 11.69 | 11.45 |
| Risk | 29.01 | 32.50 | 39.75 |
| **Medium** Return | 13.37 | 13.93 | 13.76 |
| Risk | 31.74 | 34.56 | 47.99 |
| **Small** Return | 15.33 | 14.34 | 13.79 |
| Risk | 34.41 | 47.99 | 49.24 |

In this formula, $\sigma_M$ is the market standard deviation and all other variables were defined earlier. Since the M-squared is the Sharpe ratio multiplied by the market standard deviation with the added risk-free rate, the ranking of mutual funds based on their risk-adjusted return would be identical to that of the Sharpe ratio. The major advantage of the M-squared measure, as discussed by Edwards and Samant (2003), is its economic benefits that allow the investor to compute the optimal degree of leverage to reach the optimum rate of return.

## Data

The data for mutual funds have been retrieved from Morningstar database. Large, medium, and small capitalization mutual funds are selected randomly from each Morningstar category, keeping separate growth, blend and value funds in each capitalization category. Standard and Poor's Index Services are the source of data for the S&P 500 Index, while the T-bills rates are from the U.S. Treasury website. The quarterly performance spanning the period July 1, 1994 – June 30, 2007, a total of fifty-two quarters, was used to estimate average annual returns over this period and to calculate their standard deviations. The selected period includes two periods of rising stock market and a recession in the early part of 2000s, reflecting business cycles in the economy. To

| Table 3<br>Average Risk-Adjusted Returns<br>Sharpe Ratios and M-Squared Measures 1994-2007 | | | | | | |
|---|---|---|---|---|---|---|
| | Large | | Medium | | Small | |
| | Sharpe | M-Squared | Sharpe | M-Squared | Sharpe | M-Squared |
| Value | (4) 1.12 | (4) 3.91 | (2) 1.20 | (2) 4.16 | (1) 1.33 | (1) 4.57 |
| Blend | (6) 0.96 | (6) 3.41 | (3) 1.16 | (3) 4.04 | (5) 1.10 | (5) 3.85 |
| Growth | (9) 0.76 | (9) 2.78 | (7) 0.83 | (7) 3.00 | (8) 0.82 | (8) 2.97 |

( ) = Indicates ranking of mutual funds

further observe and analyze the behavior of mutual funds, the selected period was then broken into two sub-periods – the first sub-period covering the second half of the 1990s and the second sub-period spanning the first half of the 2000s. The first sub-period is characterized by the relatively uneventful, rising stock market and also by the crazy gallop of tech and Internet stock prices in the late 1990s. The second subperiod reflects the aftermath of the Internet stock bubble and external shocks such as the events of September 11, 2001.

## Empirical Results

Table 2 summarizes the average annual returns and standard deviations of selected groups of mutual funds for the entire period under study.

The results in Table 2 show that mutual funds with higher returns also experienced higher fluctuations in their returns, as expected. Even within one capitalization category, the standard deviations are higher for growth funds than for value funds, meaning that growth mutual funds, as expected, are more volatile than value mutual funds. It is interesting to note that the S&P 500 index achieved only 10.70 percent annually on average for the same time period while its average standard deviation was 31.3 percent.[4] This return is relatively close to the average annual return of large growth mutual funds, but it exhibits higher volatility. This similarity is not surprising since the S&P 500 index is comprised of 500 large companies. The market return is somewhat lower than 15.33 percent achieved by

small value funds with a 34.4 percent standard deviation over the same period of time. These results are consistent with Bogle's findings (1999).

Table 3 reports the calculated risk-adjusted annual returns (the Sharpe ratio and the M-squared measure) of the mutual funds in each of the nine categories.

The Sharpe ratio values in Table 3 are consistent with the risk-return trade-off, as the risk-adjusted rate of return for the riskier small funds is larger than for the larger funds. The findings in the study show that the Sharpe ratios are very low, some even negative, for large cap mutual funds and growth funds; small and medium value and blend funds have the highest Sharpe ratio values. For 295 researched mutual funds, the Sharpe ratio ranged from -0.45 to 1.73.

The sharp differences in performance and risk among large, medium and small cap mutual funds lead to large differences in the risk-adjusted returns as measured by the Sharpe ratio. The results here are somewhat different from Bogle's (1999) finding; his calculations gave much higher Sharpe ratios for large cap mutual funds and low risk-adjusted returns for small caps. However, the reason for these differences could be the time period in which the data were collected. Bogle studied the performance of mutual funds over the period of 1992-1996 while this paper concentrated on a longer period from 1994 to 2007.

The results of the M-squared measure, as reported in Table 3, indicate the

small-cap value funds, followed by the mid-cap value funds, have exhibited the highest risk-adjusted rates of return.

Unlike value funds, all three types of growth funds have had the lowest M-squared values, ranking at the bottom of the nine mutual fund categories. In fact, a close comparison of rankings of the mutual funds under study, as shown in parentheses, demonstrate the identical ranking of the funds by the Sharpe ratio and the M-squared measure, as expected. The major advantage of the latter measure is its ability to allow investors to use leverage (borrowing and lending) to earn a higher return than the market index without taking higher risk[5].

The next step is to determine if the risk-adjusted returns of the mutual funds, as measured by the Sharpe ratios, are statistically equal. The comparison of several means is accomplished by using the F statistic to compare variations within the group with the variation among groups. The study performs a one-way analysis of variance to compare the means of nine Morningstar samples. The objective is to test the following null and alternative hypotheses:

$H_O$: $\mu1 = \mu2 = \ldots = \mu9$

$H_A$: not all of the means are equal, where $\mu_1, \mu_2, \ldots, \mu_9$ are sample means.

The ANOVA model assumes that the population standard deviations are equal. Statistically, the populations are assumed to have equal standard deviations if the largest standard deviation divided by the smallest standard deviation is less than two. For these samples the ratio is 1.7, allowing for a one-way analysis of variance can be performed. The computed F-value will be assessed at a 5 percent significance level with 8 degrees of freedom for the numerator and 286 degrees of freedom for the denominator. If F-value is greater than 1.95 or less than −1.95, the null hypothesis must be rejected. The conclusion can also be confirmed by the P-value, the smallest significance level at which

| Table 4 | | | |
|---|---|---|---|
| **Comparison of Means 1994-2007** | | | |
| One-way ANOVA: LV, LB, LG, MV, MB, MG, SV, SB, SG | | | |
| NDF | DDF | F-value | P-value |
| 8 | 286 | 14.82 | 0.000*** |

*** Significance <0.001

**Table 5**
**Annual Returns and Standard Deviations of Mutual Funds (%) and Comparison of Means**

| | 1994-1999 | | 2000-2007 | |
|---|---|---|---|---|
| | Average Return | Average Risk | Average Return | Average Risk |
| Large | 21.23 | 32.43 | 4.87 | 32.37 |
| Medium | 20.08 | 39.61 | 8.97 | 37.47 |
| Small | 16.89 | 41.35 | 12.64 | 41.11 |

| One-Way ANOVA: LV, LB, LG, MV, MB, MG, SV, SB, SG | NDF | DDF | F-value | P-value | NDF | DDF | F-value | P-value |
|---|---|---|---|---|---|---|---|---|
| | 8 | 286 | 19.53 | 0.000*** | 8 | 286 | 56.75 | 0.000*** |

*** Significance <0.001

the null hypothesis can be rejected. If P-value is less than 0.05, then the null hypothesis must be rejected. The results of the analysis are summarized in Table 4.

The F-value is significantly larger than the critical value corresponding to the 8 degrees of freedom in the numerator and 286 degrees of freedom in the denominator. In addition, the P-value of 0.000 is very significant; therefore, there is enough evidence to reject $H_O$ in favor of $H_A$.

Unfortunately, the results of this analysis are incomplete because a small P-value only tells us that the group means differ without specifying which means differ from each other. This issue can be resolved by the multiple comparison method, which can be used only after rejecting the previous null hypothesis. To perform a multiple comparison procedure, t statistic must be computed for each pair of means. It is essential to use the least-significant differences method, in which α = 0.05 must be divided by the number of possible combinations of pairs, or thirty-six in this case. Therefore, the P-value must be less than 0.001 in order to be significant. The first two columns of Table 6 summarize the results of the t-tests. For about one half of the pairs, the P-value is less than 0.001; the other half of the pairs have a P-value that is greater than 0.001, implying that there are no statistically significant differences between their means.

Table 5 shows the average rates of return and standard deviations of mutual funds during the two subperiods. The first subperiod (1994-1999)

is associated with the stock market boom, the growth of dot com companies, and what Alan Greenspan referred to as irrational exuberance. Table 5 shows that despite the higher volatility of the equities market during this period, investors were investing in the stock market (and mutual funds). The expected risk-return relationship does not seem to have worked for many investors, as they continued to invest in higher risk small mutual funds despite the fact that the returns were higher in larger mutual funds. The results for the second subperiod (2000-2007) seem to be more consistent with the risk-return concept as they expectedly show that higher risk small mutual funds had higher standard deviations.

Table 7 also shows the results of the means comparisons for different types of mutual funds for the two subperiods.

The results of ANOVA in Table 7 indicate that the means of different mutual funds for both subperiods included in this study were significantly different from each other, implying the market is not efficient as it is possible for some average returns of some mutual funds to be significantly different from others.

The next part of the test is to compare the means of pairs of mutual funds for both sub-periods to see if the returns are significantly different from each other.

The results, as shown in the remaining columns in Table 6, indicate that in the vast majority of cases, the P-values are below 0.001, implying significant differences among the means of the pairs of mutual funds in each of the subperiods. It is interesting to note that when the study compared the means of pairs of the mutual funds for the entire period (1994-2007), about one half of the pairs had statistically similar means; when the comparison is made for each of the two subperiods, the results indicate that in each subperiod there were significant differences among the means. This finding confirms that the equities market behaved very differently from 1994 to 2007, and that the structural changes in 2000 and 2001, as noted earlier have distorted the results of the study for the entire period. Testing the market efficiency for the two subperiods is more reliable as it eliminates distortions caused by the unexpected shocks in 2000 and 2001.

The next step was to see if the results would be different if only three groups were compared; the one-way analysis of variance was used to compare large, medium, and small capitalization mutual funds. Again, the assumption of equal standard deviations is also satisfied for these three groups. The analysis followed the same procedure as in the comparison of the nine mutual funds categories. The new significance level is 1.67 per-

| | 1994-2007 | | 1994-1999 | | 2000-2007 | |
|---|---|---|---|---|---|---|
| *Table 6*<br>**Test of Differences in Means** | | | | | | |
| | **T-test value** | **P-value** | **T-test value** | **P-value** | **T-test value** | **P-value** |
| Large Value vs. Large Blend | 2.78 | 0.003** | 2.84 | 0.003** | 6.17 | 0.000*** |
| Large Value vs. Large Growth | 7.84 | 0.000*** | 3.94 | 0.000*** | 12.61 | 0.000*** |
| Large Value vs Mid Value | 1.22 | 0.114 | 3.01 | 0.002** | 4.80 | 0.000*** |
| Large Value vs Mid Blend | 0.49 | 0.314 | 2.40 | 0.010** | 2.79 | 0.003** |
| Large Value vs Mid Growth | 5.41 | 0.000*** | 1.42 | 0.079 | 5.53 | 0.000*** |
| Large Value vs Small Value | 3.71 | 0.000*** | 6.62 | 0.000*** | 10.52 | 0.000*** |
| Large Value vs Small Blend | 0.32 | 0.375 | 7.06 | 0.000*** | 4.74 | 0.000*** |
| Large Value vs Small Growth | 4.55 | 0.000*** | 3.90 | 0.000*** | 2.31 | 0.012* |
| Large Blend vs Large Growth | 3.17 | 0.001*** | 0.25 | 0.402 | 3.97 | 0.000*** |
| Large Blend vs Mid Value | 3.03 | 0.002** | 4.35 | 0.000*** | 9.06 | 0.000*** |
| Large Blend vs Mid Blend | 2.52 | 0.007** | 3.83 | 0.000*** | 7.01 | 0.000*** |
| Large Blend vs Mid Growth | 1.82 | 0.037 | 3.55 | 0.000*** | 0.77 | 0.222 |
| Large Blend vs Small Value | 4.73 | 0.000*** | 6.55 | 0.000*** | 13.38 | 0.000*** |
| Large Blend vs Small Blend | 1.78 | 0.040* | 7.67 | 0.000*** | 8.64 | 0.000*** |
| Large Blend vs Small Growth | 1.57 | 0.061 | 4.79 | 0.000*** | 1.98 | 0.027* |
| Large Growth vs Mid Value | 7.19 | 0.000*** | 5.56 | 0.000*** | 15.28 | 0.000*** |
| Large Growth vs Mid Blend | 7.08 | 0.000*** | 5.08 | 0.000*** | 12.55 | 0.000*** |
| Large Growth vs Mid Growth | 1.17 | 0.122 | 4.76 | 0.000*** | 5.09 | 0.000*** |
| Large Growth vs Small Value | 11.12 | 0.000*** | 8.84 | 0.000*** | 21.82 | 0.000*** |
| Large Growth vs Small Blend | 5.28 | 0.000*** | 9.84 | 0.000*** | 13.89 | 0.000*** |
| Large Growth vs Small Growth | 0.83 | 0.206 | 6.42 | 0.000*** | 5.40 | 0.000*** |
| Mid Value vs Mid Blend | 0.58 | 0.283 | 0.57 | 0.286 | 1.39 | 0.085 |
| Mid Value vs Mid Growth | 5.25 | 0.000*** | 1.68 | 0.048* | 8.75 | 0.000*** |
| Mid Value vs Small Value | 1.60 | 0.057 | 2.08 | 0.021* | 4.61 | 0.000*** |
| Mid Value vs Small Blend | 1.26 | 0.106 | 2.37 | 0.010** | 0.37 | 0.357 |
| Mid Value vs Small Growth | 4.35 | 0.000*** | 0.42 | 0.339 | 4.95 | 0.000*** |
| Mid Blend vs Mid Growth | 4.77 | 0.000*** | 1.06 | 0.148 | 6.64 | 0.000*** |
| Mid Blend vs Small Value | 2.46 | 0.009** | 2.95 | 0.002** | 5.76 | 0.000*** |
| Mid Blend vs Small Blend | 0.68 | 0.251 | 3.17 | 0.001*** | 1.58 | 0.060 |
| Mid Blend vs Small Growth | 3.99 | 0.000*** | 1.06 | 0.146 | 3.50 | 0.000*** |
| Mid Growth vs Small Value | 7.39 | 0.000*** | 4.61 | 0.000*** | 13.09 | 0.000*** |
| Mid Growth vs Small Blend | 3.81 | 0.000*** | 5.01 | 0.000*** | 8.48 | 0.000*** |
| Mid Growth vs Small Growth | 0.11 | 0.454 | 2.34 | 0.011* | 1.50 | 0.069 |
| Small Value vs Small Blend | 2.72 | 0.004** | 0.11 | 0.458 | 3.53 | 0.000*** |
| Small Value vs Small Growth | 6.20 | 0.000*** | 1.95 | 0.029* | 7.93 | 0.000*** |
| Small Blend vs Small Growth | 3.16 | 0.001*** | 1.95 | 0.028* | 4.97 | 0.000*** |

* Significance <0.05    ** Significance <0.01    *** Significance <0.001

cent and was determined by the formula mentioned above. Therefore, the P-values must be less than 0.0167 in order to be significant. Table 7 summarizes the results of the ANOVA test and summarize the results of the test for the subperiods.

The results of this test are more consistent, showing that there is a statistically significant difference in means, which implies that risk-adjusted returns of large, medium and small cap mutual funds are not equal. These findings contradict the efficient market hypothesis.

The t-test results in Table 7 show that the differences in means for the entire period are statistically significant only for large capitalization stocks when compared to medium or small capitalization stocks. However, the differences in means of medium and small capitalization stocks are not statistically significant. The results of testing for differences in means of pairs of mutual funds for the subperiods show significant difference between all pairs of mutual funds.

Another way of testing the hypothesis is to compare all value, blend, and growth funds. The standard deviations in this case also meet the equality assumption. The analysis follows the same format, and the results are listed in Table 8.

The results indicate that for both the entire period and the sub-periods, the average returns of value, blend and growth mutual funds are not equal. This is further evidence that contradicts the efficient market hypothesis.

The results of this analysis for pairs of mutual funds (Tables 9 & 10) indicate that three pairs of mutual funds have significant differences in their returns. The differences are very large for value vs. growth and blend vs. growth categories, while the difference between value and blend funds is much smaller both for the entire period and for the sub-periods. This is not surprising as there is a very vague distinction between these two groups of mutual funds.

### Table 7
### Comparison of Means – Market Capitalization

| One-Way ANOVA: Large Cap, Medium Cap, Small Cap | | | | |
|---|---|---|---|---|
| Period | NDF | DDF | F-value | P-value |
| 1994-2007 | 2 | 292 | 4.15 | 0.01664* |
| 1994-1999 | 2 | 292 | 64.10 | 0.000*** |
| 2000-2007 | 2 | 292 | 50.92 | 0.000*** |

* Significance <0.05    ** Significance <0.01    *** Significance <0.001

### Table 8
### Comparison of Means – Investment Objectives

| One-Way ANOVA: Value, Blend, Growth | | | | |
|---|---|---|---|---|
| Period | NDF | DDF | F-value | P-value |
| 1994-2007 | 2 | 292 | 49.13 | 0.000*** |
| 1994-1999 | 2 | 292 | 5.77 | 0.003** |
| 2000-2007 | 2 | 292 | 74.20 | 0.000*** |

* Significance <0.05    ** Significance <0.01    *** Significance <0.001

## Conclusions and Implications

The main objective of this research was to test the efficient market hypothesis for different market capitalization and investment styles of mutual funds. Since past research has yielded mixed results, with some scholars finding evidence that supported the EMH and other researchers providing evidence of market inefficiency, there was no certainty in expectation. If the market is efficient, the investor would be indifferent about investing in either type of mutual funds. In the absence of an efficient market, the investor needs to know the type of mutual funds that would bring higher risk-adjusted returns.

The results of the study for the entire period of 1994-2007 as well as the two subperiods (1994-1999 and 2000-2007) were interesting and somewhat surprising. The overall conclusion is that the market is not always efficient, which makes it possible for an investor or a mutual fund manger to earn higher than expected returns. The next step is to determine which categories of mutual funds have brought higher risk-adjusted returns. Table 2 reports

the Sharpe ratios and the M-squared measures for nine categories of mutual funds. They provide a very clear idea about the funds' returns relative to their volatility. Small caps value funds have provided the highest risk-adjusted returns for the entire period, whereas the growth funds have exhibited lower returns. Therefore, choosing the funds from the category that has the highest Sharpe ratio or the largest M-squared measure, namely small and medium value and blend mutual funds, should lead to earning higher returns than the market would earn. However, investors should not rely solely on the Sharpe ratio or the M-squared measure to determine the funds risk-return trade-offs. The discussion of other indicators such as the Treynor's Performance measure or the Jensen's alpha is beyond the scope of this study.

## Notes

1. For simplicity, this research will combine small and micro-cap stock funds together.
2. Subsequently referred to as the Sharpe ratio.
3. A suggestion by an anonymous reviewer to include the M-squared measure in the

**Table 9**
**Test of Differences in Means – Size**

| One-Way ANOVA | 1994-2007 | | 1994-1999 | | 2000-2007 | |
|---|---|---|---|---|---|---|
| | T-test value | P-value | T-test value | P-value | T-test value | P-value |
| Large Cap vs Mid Cap | -2.10 | 0.018 | 6.30 | 0.000 | 6.380 | 0.000*** |
| Large Cap vs Small Cap | -2.80 | 0.003 | 11.57 | 0.000 | 9.900 | 0.000*** |
| Mid Cap vs Small Cap | -0.74 | 0.229 | 4.70 | 0.000 | 3.710 | 0.000*** |

*** Significance <0.001

**Table 10**
**Test of Differences in Means – Objectives**

| One-Way ANOVA | 1994-2007 | | 1994-1999 | | 2000-2007 | |
|---|---|---|---|---|---|---|
| | T-test value | P-value | T-test value | P-value | T-test value | P-value |
| Value vs Blend | 2.91 | 0.002 | 0.32 | 0.374 | 3.050 | 0.001*** |
| Value vs Growth | 10.63 | 0.000 | 3.36 | 0.000 | 12.980 | 0.000*** |
| Blend vs Growth | 6.43 | 0.000 | 2.65 | 0.004 | 8.200 | 0.000*** |

*** Significance <0.001

study is highly appreciated.

4. An alternative market proxy is the Wilshire 5000 Index. The average return for this index since its inception in 1991 until September of 2007 was 11.7% with a standard deviation of 13.52% and a Sharpe ratio of 0.53. Using this index would have no effect of the Sharpe ratio, but it would result in lower M-squared measures for the funds under study.

5. For more details about the use of the leverage factor and the M-squared measure, please see Edwards and Samant (2003).

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