# Does Fund Size Matter?: An Analysis of Small and Large Bond Fund Performance

James Gallant
Senior Honors Project
April 23, 2007

I. Abstract

Mutual funds have become a staple for retirement savings and have received much research attention. Bond funds, though, have received little attention to date, and the effects of fund size on performance are still in dispute. Using cross sectional and time series regression analysis, the performance of high yield and corporate bond funds are contrasted, with potential causes for the differences identified. A few fundamental economic variables are found to explain a large portion of fund returns. Bond index returns are found to have the greatest impact of any variable on fund returns, with the most pronounced effect on large corporate bond funds. The impact of fund size on performance is also examined, with evidence suggesting that after a point fund returns are negatively impacted as net assets grow. This poses a key microeconomic question regarding the benefits and costs of fund scale.

## II. Introduction

The mutual fund industry continues to play an important role in the U.S. economy. As of 2004, families held an average of 46.7% of total wealth in retirement accounts and pooled investment funds, an increase of 5.8% from only 9 years earlier.[1] At the close of 2005, U.S. mutual fund assets approached $9 trillion, up from less than $150 billion 25 years earlier; currently, nearly half of U.S. households (47.5%) invest in mutual funds.[2] With mutual funds becoming an increasingly used conduit for investments and retirement savings, investors spend significant time in identifying funds with the potential to outperform the market, evident by the growing availability of publications and rating services. Extensive academic literature has attempted to explain mutual fund performance, but to date the findings have been diverging.

While mutual fund performance has been given significant research attention, current research focuses primarily on equity and hybrid funds. In

[1] Federal Reserve Board, Survey of Consumer Finances
[2] Investment Company Institute (ICI)

attempting to explain fund performance, several fund attributes have been examined, but until recently the fund size has received little direct attention. Using the findings of research focused on equity funds, this study will examine funds that invest primarily in debt securities. More specifically, it will look at bond funds whose main investment category is defined as either high-quality corporate bonds or high-yield corporate bonds and examine whether size impacts the performance of bond funds in general, and if this effect differs across the two fund investment styles. Additionally, it will examine the importance of three fund specific characteristics (turnover, expenses, and investment style) in explaining the returns of different sized funds.

Studying bond fund performance is important for several reasons. First, as mentioned above, the majority of the literature focuses on funds investing primarily in equities. Bond funds make up a notable share of the market, however, with bond funds holding $1.3 trillion, or 15%, of all U.S. mutual fund assets, including $31 billion in new inflows in 2005.[3] Second, there are relatively few influences on the returns of bond funds compared to stock funds, making it more likely that their performance can be understood. Empirical evidence suggests bond returns may be explained by as few two factors, while as many as seven are necessary to explain the returns of common stocks.[4] Finally, understanding the performance of bond funds is important to investors in choosing appropriate investments, especially since few households own individual debt securities and rely primarily on funds to invest in bonds. The

[3] ICI
[4] Elton, Gruber, and Nabar (1988) and Roll and Ross (1980).

introduction of exchange traded funds (ETFs) offers investors alternatives for bond investment, with funds tracking nearly all indices and investment styles. Therefore, if bond mutual fund performance cannot be explained, ETFs may prove the better vehicle for diversified bond investment.

Mutual fund size, or net asset value, is another area that has received little direct research attention, but is of increasing importance. Since 1995, the number of mutual funds in the U.S. has increased nearly 50%, from 5,761 in 1995 to 8,454 in 2005. The total number of funds has remained fairly stagnant since 2000. Mutual fund assets have grown much faster, however, increasing from $2.8 trillion in 1995 to $8.9 trillion in 2005.[5] The surge in mutual fund assets has been fueled both by surging investor demand and strong investment performance over the past decade. Demand has been driven by the shift in U.S. retirement system towards fixed contribution plans, with 401(k)s among the primary vehicles for retirement savings. Since 1995, retirement has been the dominant motive for savings in the U.S.[6] Regardless of the reason, the fact remains that growth in mutual fund assets is significantly outpacing growth in the number of funds. As a result, funds have a greater asset base to invest, making an understanding of the impacts of fund size important to investor decisions. Additionally, the issue is important in relation to persistence in fund performance, which is dependent on the scale-ability of fund investments.

## III. Literature Review

[5] ICI
[6] Federal Reserve Board, Survey of Consumer Finance

As already mentioned, the conclusions drawn by current mutual fund research vary widely. The majority of early studies, which focused on equity funds, dealt with the issue of managerial performance, with the results of Treynor (1965), Sharpe (1966), and Jensen (1968) supporting the efficient market hypothesis, with fund managers unable to consistently beat the market. More recent literature, again looking at primarily equity funds, has called the notion of market efficiency into question, however, with Grinblatt and Titman (1992) and Ibbotson and Patel (2002), among others, finding evidence of persistence in fund performance. Wermers (2000) finds that well picked stocks allow fund managers to cover their costs, while in contrast Davis (2001) finds little performance persistence among small-cap funds. Even after decades of research, a divide still remains regarding the ability of fund managers to outperform the market, and thus other factors have been examined to help explain fund performance.

If it cannot be determined whether a fund manager can outperform the market on a consistent basis, then it makes sense to examine what other fund factors impact performance. Again, academic literature has reached conflicting conclusions regarding the impact of several fund attributes. Among the characteristics considered by several studies are fund expense ratio, turnover, and investment style or objective.

The impact of fund expenses has been a fairly controversial topic in mutual fund literature. While conventional wisdom would suggest that higher expenses would erode returns, other literature suggests that superior fund managers are able to charge higher fees. Fund expenses have been found to

negatively impact returns, first by Sharpe (1966), and later by several others including Golec (1996) and Prather, Bertin, and Henker (2004). These findings are contrasted by Ippolito (1989), who finds fund performance is unrelated to management fees and portfolio turnover. Interestingly, Gruber (1996) finds that the best performing fund managers actually have lower fees.

Fund turnover is another variable given considerable scrutiny in recent literature, though the conclusions reached have been conflicting. Grinblatt and Titman (1994) and Wermers (2000) observe higher turnover resulting in higher returns, with Wermers noting that funds with higher turnover were likely to incur greater expenses in addition to higher returns. Carhart (1997) also notes a relationship between fund turnover and performance, though these results suggest a negative relationship between turnover and fund performance.

The impact of fund size on returns has not received much attention until recently. Still, there are several hypotheses regarding the impact of scale on fund return. Advantages to scale include greater resources for research and lower expense ratios. Others, however, argue that a larger asset base erodes performance because of costs associated with liquidity or price impact (Perold and Salomon 1991), though some trading costs are offset by economies of scale. Many studies, such as Grinblatt and Titman (1989), find mixed evidence. In any case, there is little consensus among academics.

Both Carhart (1997) and Grinblatt and Titman (1994) find no correlation between fund size and performance, but this is contrasted by Golec (1996) who finds a positive correlation. Prather et al (2004) reach similar conclusions to

Carhart and Grinblatt, but also find evidence of fund size affecting specific investment objectives. In addition to finding superior performance in small cap funds, there is evidence that as total fund assets increase the likeliness of outperforming declines, supporting the hypothesized decline in fund flexibility as its asset base increases.

Chen, Hong, Huang, and Kubik (2004) examine the role of scale on performance and find that fund returns decline with lagged fund size both before and after accounting for expenses. Furthermore, this correlation is most significant among funds trading primarily small or illiquid stocks. It is also important to note that these conclusions exclude the smallest funds (those with under $15 million under management), with some theories suggesting that the smallest funds are run at a suboptimal scale and will thus under-perform medium sized funds. Additionally, in contrast to Prather et al (2004), the study finds the negative relationship between size and performance is not driven by fund style.

The conclusions of current literature focus primarily on performance of equity and hybrid mutual funds, with hybrid funds assumed to invest in only stocks and U.S. Treasury securities. Studies focusing exclusively on bond mutual funds have found that bond funds typically under-perform when compared to appropriate indexes. Blake, Elton, and Gruber (1993) find that bond funds under-perform once expenses are considered; a one percentage point increase in fund expenses will, on average, result in a one percentage point decrease in fund returns. Elton, Gruber, and Blake (1995) reach a similar conclusion, that bond funds cannot cover their costs, also finding that the use of economic

variables leads to a more complete explanation of bond fund returns. Furthermore, both find little evidence of performance persistence; past performance holds little or no predictive power over future returns.

In examining the performance of different classes of bond funds, empirical evidence supports conventional wisdom. Cornell and Green (1991) find that on a risk adjusted basis, low-grade bond fund returns are approximately equal to the returns of high-quality bond funds in the long run. Short term distortions occur because low-grade funds typically have shorter durations and are therefore less sensitive to movements in interest rates. Low-grade bond funds are, however, more responsive to movements in stock prices, but after controlling for these two factors the returns are not statistically different.

## IV. Data & Sample

All bond mutual fund data, including performance information, fund attributes, and investment objective is provided by the Center for Research in Security Prices (CRSP) Survivor-Bias-Free U.S. Mutual Fund Database. Over the period 1998-2003, the study will examine the 50 largest and 50 smallest bond funds by total net assets for two ICDI investment objective classifications: High Quality Funds (BB) and High Yield Funds (BY). Funds classified as High Quality invest in corporate bonds rated BBB or better; funds classified as High Yield invest in corporate bonds rated BB or lower. Only funds active for the entire 1998-2003 period are considered. Monthly return and total net asset data are collected monthly. Fund characteristics, including turnover, average maturity,

and expense ratio, are collected each year. Means and standard deviations for all fund data are shown below:

**Table I. Summary Statistics**

| | | *TNA* | *Average Maturity* | *Expense Ratio* | *Turnover Ratio* | *Monthly Return* |
|---|---|---|---|---|---|---|
| *All BQ* | Mean | 1410.44 | 6.03 | 0.0093 | 1.51 | 0.48% |
| | Std. Dev. | 3622.05 | 3.23 | 0.0045 | 1.40 | 1.09% |
| *Small BQ* | Mean | 12.08 | 5.53 | 0.0119 | 1.23 | 0.45% |
| | Std. Dev. | 20.24 | 2.78 | 0.0038 | 1.18 | 1.01% |
| *Large BQ* | Mean | 2808.80 | 6.53 | 0.0066 | 1.79 | 0.50% |
| | Std. Dev. | 4725.45 | 3.56 | 0.0034 | 1.54 | 1.17% |
| *All BY* | Mean | 721.42 | 5.76 | 0.0128 | 0.71 | 0.23% |
| | Std. Dev. | 990.28 | 10.64 | 0.0047 | 0.44 | 2.63% |
| *Small BY* | Mean | 107.57 | 4.82 | 0.0141 | 0.81 | 0.22% |
| | Std. Dev. | 89.87 | 14.94 | 0.0047 | 0.50 | 2.55% |
| *Large BY* | Mean | 1335.10 | 6.70 | 0.0115 | 0.61 | 0.25% |
| | Std. Dev. | 1095.31 | 1.25 | 0.0043 | 0.33 | 2.71% |

Given the relative small size and scope of the data set, a few potential problems could result. A problem encountered in many empirical studies is survivorship bias, and this study is not an exception. Since only funds active over the entire 1998-2003 time period are considered, excluding funds lost to liquidation or merger, survivorship bias will exist. While this could result in overstated average performance measures for the fund, the impact of survivorship bias on performance measurement should not significantly detract from the question of rising fund size negatively impacting performance. However, since failed funds tend to have lower assets and poorer performance before merger or liquidation, the performance of smaller funds could be overstated. Thus, while it will not directly affect of the results for the group of large funds, by overstating the performance of small funds, survivorship bias

could cause results to imply performance advantages to small funds that do not exist.

In addition to the CRSP Mutual fund database, the CRSP Value Weighted Stock index will be employed as a measure stock performance over the time period examined. Economic measures have been obtained from the various government agencies that track them. Gross Domestic Product (GDP), Consumer Price Index (CPI), and U.S. Treasury yields have been provided by the Bureau of Economic Analysis, Bureau of Labor Statistics, and U.S. Treasury, respectively.

## V. Methodology & Characteristic Equation

Mutual fund performance is primarily affected by the macroeconomic environment and the varying performance of different investment styles. Fund returns can also be explained in large part by the overall performance of securities markets. The empirical test uses cross sectional regressions to see how performance varies with fund size. An alternative method would be to use a fixed effects approach to see whether changes in fund performance are related to changes in fund size. A cross sectional approach is used instead of a fixed-effects approach to avoid bias from regression to the mean. This bias could arise should a fund experience a year of superior performance, which would result in increased net assets, then regress to a more normal level of returns, suggesting that increased fund size results in decreased returns.

The characteristic equation, which includes economic and fund specific variables, is represented below:

$$P_t = \alpha_0 + \alpha_1 G_t + \alpha_2 G_{t-1} + \alpha_3 G_{t-2} + \alpha_4 I_t + \alpha_5 I_{t-1} + \alpha_6 I_{t-2} + \alpha_7 RS_t + \alpha_8 RB_t +$$

$$\alpha_9 TR_t + \alpha_9 DR_t + \alpha_{10} EXP_{j,t} + \alpha_{11} TO_t + \alpha_{12} OBJj + \alpha_{13} TNA_{j,t} + \varepsilon_t$$

where:

$P_t$ is the excess return of a given fund in period t,
$\alpha_i G_t$ is a set of lagged economic growth variables from period t – 2 to t,
$\alpha_i I_t$ is a set of lagged inflation variables from period t – 2 to t,
$RS_t$ is the excess return on the CRSP Value Weighted Stock index in period t,
$RB_t$ is the excess return on the Vanguard Total Bond index in period t,
$TR_t$ estimates term risk in period t,
$DR_t$ estimates default risk in period t,
$EXP_{j,t}$ is the expense ratio of fund j in period t,
$TO_{j,t}$ is the turnover of fund j in period t,
$OBJ_j$ is the ICDI investment objective of fund j,
$TNA_{j,t}$ is the total net assets of fund j in period t,
$\varepsilon_t$ is the random error.

Since the characteristic equation also utilizes significant time series data, time series regressions will be used in attempt to verify the findings of the cross sectional regressions. One potential problem could arise with the fund characteristic variables, however, as they are reported yearly, while all other data occurs monthly, thus failing to capture the impact in changes over time. Therefore, in the time series analysis the fund characteristic variables will be excluded.

The first three variables attempt to capture the impact of changing economic conditions and expectations on security prices. Returns on securities can largely be explained by changes in overall macroeconomic conditions, which are captured in the growth and inflation variables. The lagged economic growth

variable will measure the impact of changes in economic growth on fund returns using U.S. real GDP growth from the preceding two quarters and the quarter of the return. A similar two period lag will measure the impacts of changes in the Consumer Price Index. This approach is consistent with the findings of Ederington and Lee (1993) and Elton et al (1995), who find that unexpected changes in macroeconomic variables have explanatory power over changes in bond prices. Accelerating GPD growth and rising inflation should both be expected to have a negative affect on fund returns, as both are generally associated with rising yields and falling bond prices. As High Yield funds are generally make more of their returns through trading, this impact will likely be more pronounced. The third variable, excess returns on the stock market, can also be viewed as an economic variable, as it indicates general expectations about economic conditions. Also, it should help explain bond returns because bond yields typically have an inverse relationship to stock market returns.

The fourth variable, the returns on the bond index, should hold the most explanatory power. In looking for a single factor that best explains the returns of an individual stock, or fund of stocks, a market index would probably be the best single variable, and this also holds true for bonds. While the specific holdings of individual funds vary, the Vanguard Total Bond index is broad based, and a good measure of the overall performance of U.S. investment grade bonds. Its coverage does include high yield bonds as well, though it primarily tracks corporate bonds.

The next group of variables examines two factors specific to bond returns: term risk and default risk. Both default risk and term premium have been shown to impact bond prices. The equation estimates term risk in two ways. First, overall term premium applied to any bond in period t is estimated by the difference in yields of a 30 year Treasury bill and a 90 day Treasury note. Second, for each specific fund, the level of term risk is estimated using the average maturity of the fund. Thus, changes in fund returns due to changing term premiums required by the market and changes in fund returns due to changes in the maturity of specific fund holdings are captured. Consistent with Elton et al (1995) and other bond pricing models, return series are used to measure default risk. The default risk variable is the difference between the returns of the Lehman Brothers High Yield bond index and the Dow Jones Corporate Bond Index. Though it does not capture the actual default risk for specific funds, it will provide a measure of changes in the default risk premium charged by investors over time. Higher default and term risk premiums should result in higher fund returns, especially for high yield funds.

Three fund specific attributes are addressed in the equation: expense ratio, fund turnover, and fund investment objective. Expense ratios and fund returns have been show to have a nearly perfect negative correlation by Blake et al (1993), and this should hold true. Given the cost advantages related to economies of scale, small funds typically have higher expenses and should see a more significant negative impact of fund expenses. Regarding fund turnover, evidence suggests that even with increased trading costs, higher fund turnover

leads to higher returns for equity funds. High Quality funds are typically less active traders than High Yield funds, and it is expected that turnover will have greater influence on returns for these funds. The difference in fund objective should also explain the difference in returns of the two fund groups. Simply put, High Yield funds take greater risk, and thus generally have higher returns.

The key variable this paper attempts to examine is the impact of fund size on bond fund returns. For equity funds, it has been found that fund returns decline with lagged fund size, especially in funds that trade in small and illiquid stocks. Although corporate bonds are fairly liquid, high yield bonds trade less frequently, so the negative impact of rising net assets should be more pronounced for the high yield funds. To address the issue of scale, fund size is defined as the log of the fund's total net assets.

## VI. Results

Though the overall results lack conclusiveness, as there is a question of statistical significance for many variables (most likely due to a less than optimum model and relatively small sample size), much of the performance of bond funds can be explained by the results. First, the greatest influence on fund performance, regardless of fund size or investment style, is the performance of a general bond index. Economic factors also hold significant influence, with stock market returns and risk premiums having strong correlation to performance. Second, higher expense ratios negatively impact fund performance of all fund types, refuting the idea that better managers can charge higher fees. And finally,

the performance of corporate bond funds of any size appear to have fewer influences than high yield funds, as the results of the empirical test explain a much greater portion of the variation. In addition, the results suggest, but certainly do not prove, several relationships between fund performance and fund size. Most notably, the results suggest a positive relationship between NAV and returns for small funds, and a negative relationship between NAV and returns for large funds.

Shown in Table II are cross sectional regression results for each group of 50 funds. As can be seen, nearly all variables are significant, with exception to inflation in period t, fund turnover, and LogTNA. Inflation in the month of the fund return could be insignificant because inflation information is not fully available before official data releases, and thus not correctly priced in, with fund managers basing decisions on forecasted data. The lack of correlation between fund turnover and returns is inconsistent with the findings of studies on equity funds, which have generally found a negative relationship. Additionally, although TNA has no statistically significant relationship to performance, there is suggestion of differences in performance factors between funds of different sizes.

**Table II. Full Regression Results**

| **Sm BY** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *TR* | *DR* | *EXP* | *TO* | *LogTNA* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Coefficient* | 0.00 | 0.45 | -0.32 | -0.49 | 0.11 | -0.48 | -0.38 | 0.19 | 0.75 | 0.37 | 1.54 | -0.16 | 0.00 | 0.00 |
| *Std Error* | 0.00 | 0.08 | 0.07 | 0.08 | 0.16 | 0.15 | 0.15 | 0.01 | 0.08 | 0.03 | 0.05 | 0.07 | 0.00 | 0.00 |
| *t Stat* | 1.91 | 5.46 | -4.30 | -6.43 | 0.71 | -3.26 | -2.56 | 25.91 | 9.51 | 12.52 | 29.65 | -2.19 | -1.16 | 0.24 |
| *p Value* | 0.06 | 0.00 | 0.00 | 0.00 | 0.48 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.25 | 0.81 |
| **Lg BY** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *TR* | *DR* | *EXP* | *TO* | *LogTNA* |
| *Coefficient* | 0.00 | 0.42 | -0.29 | -0.47 | 0.17 | -0.79 | -0.43 | 0.21 | 0.76 | 0.40 | 1.70 | -0.27 | 0.00 | 0.00 |
| *Std Error* | 0.00 | 0.08 | 0.08 | 0.08 | 0.17 | 0.16 | 0.16 | 0.01 | 0.08 | 0.03 | 0.06 | 0.09 | 0.00 | 0.00 |
| *t Stat* | 1.12 | 4.97 | -3.76 | -5.98 | 1.00 | -5.07 | -2.73 | 28.10 | 9.24 | 12.71 | 30.70 | -3.03 | -2.18 | 0.39 |
| *p Value* | 0.26 | 0.00 | 0.00 | 0.00 | 0.32 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.69 |
| **Sm BQ** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *TR* | *DR* | *EXP* | *TO* | *LogTNA* |
| *Coefficient* | 0.00 | -0.06 | -0.03 | 0.01 | -0.12 | -0.01 | 0.02 | 0.01 | 0.90 | -0.03 | -0.07 | -0.09 | 0.00 | 0.00 |
| *Std Error* | 0.00 | 0.02 | 0.02 | 0.02 | 0.04 | 0.03 | 0.03 | 0.00 | 0.02 | 0.01 | 0.01 | 0.02 | 0.00 | 0.00 |
| *t Stat* | 4.05 | -3.16 | -1.67 | 0.62 | -3.21 | -0.43 | 0.45 | 6.12 | 49.57 | -3.69 | -6.04 | -4.41 | 0.16 | -0.13 |
| *p Value* | 0.00 | 0.00 | 0.10 | 0.54 | 0.00 | 0.67 | 0.65 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.87 | 0.90 |
| **Lg BQ** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *TR* | *DR* | *EXP* | *TO* | *LogTNA* |
| *Coefficient* | 0.00 | -0.04 | -0.04 | 0.01 | -0.13 | -0.02 | -0.03 | 0.03 | 0.97 | 0.02 | 0.10 | -0.15 | 0.00 | 0.00 |
| *Std Error* | 0.00 | 0.03 | 0.03 | 0.03 | 0.05 | 0.05 | 0.05 | 0.00 | 0.03 | 0.01 | 0.02 | 0.04 | 0.00 | 0.00 |
| *t Stat* | 0.79 | -1.40 | -1.54 | 0.47 | -2.37 | -0.35 | -0.64 | 12.08 | 36.41 | 1.97 | 5.47 | -4.02 | 0.64 | 0.56 |
| *p Value* | 0.43 | 0.16 | 0.12 | 0.64 | 0.02 | 0.73 | 0.52 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.52 | 0.58 |

* All 0.00 values rounded from 1 x 10^-5 or less

Of most significance from the results is the dominance of economic and market factors in determining fund performance, especially for high yield funds. Economic growth and lagged inflation both significantly impact fund returns. The coefficients for lagged growth have negative coefficients, however, which is somewhat unexpected. The positive coefficient for growth in period t does not match the original hypothesis, but it seems reasonable that high yield bonds would react similarly to stocks in periods of economic growth. Though the coefficients for high quality bond funds lack the same statistical significance, they fall more in line with original expectations, with rising economic growth resulting in a slight decline in fund performance. Lagged inflation also falls in line with expectations, as rising inflation correlates with declining fund performance. As with economic growth, however, is only statistically significant for high yield

funds. In general, the coefficients differ only across fund styles, with only slight differences in coefficients between small and large funds of the same investment objective.

Similar to individual bond performance, bond fund performance is mainly a function of total bond market returns. As shown, fund returns have a significant and strong relationship with returns on the aggregate bond index. The coefficient is much higher for both large and small corporate bond funds, which could occur for several reasons. First, the index, though based on all bonds, likely mirrors the performance of high quality bonds better than high yield bonds. Small funds often have smaller, more illiquid holdings that cannot be well captured by an index. Second, high quality bonds generally have more stable trading patterns and returns, meaning high quality funds will not deviate as greatly from the index as high yield funds. Again, the difference between the coefficients for small and large high yield funds is superficial. There is, however, a fairly significant difference between small and large high quality funds, which could support the liquidity hypothesis. In other words, large high quality funds must own a larger number of corporate bonds because of the larger asset base, and are therefore more likely to move with an index comprised largely of corporate bonds.

The relative stability of corporate bonds could also explain why high yield funds see greater returns based on stock market performance. Both investment categories show a positive relationship to stock market returns (with small funds being slightly less affected), but it is fairly minimal for high quality funds. As shown, the impact of stock market returns on fund performance is much greater

on high yield funds. This could be explained by the risk tolerance of the market at any given time. Stock market returns are a fairly good indicator of investor sentiment, and as market returns rise, investors are more likely to take on risky investments, such as low grade bonds.

Just as the performance of high yield funds is more affected by the returns of the stock market, the effects of risk premium and term premium are greater, as expected. High quality funds, on the other hand, are relatively unaffected by changing risk premiums. This is fairly intuitive, as rising risk premium implies investors are moving to relatively safer investments, thus depressing the yields of less risky bonds. The results suggest large fund returns are more affected by both term and default risk. The difference is more pronounced for high quality funds, where the signs are opposite for the small and large group, though an explanation for this is not readily apparent. It is possible that the difference is attributable to the funds sampled, as the mean average maturity was greater for large funds included (see Table I. Summary Statistics). Whether this is due to random chance or a tendency of larger funds to hold more long term securities can not be determined. The difference in coefficients for default risk between small and large funds could also possibly be explained by diversification benefits. At times when investors require a higher default premium, larger funds are able to reap the higher returns, while diversifying away the majority of the additional risk.

Finally, as expected, higher fund expense ratios result in lower fund returns on average. This is consistent with earlier findings that bond funds are

not able to cover their costs. What is interesting, however, is that the negative influence of fund expense ratio is greater for large funds than for small funds. Economies of scale imply that expenses should have less effect on larger funds. What this analysis does not consider, however, is the size of the fund family. A small bond fund for a large family such as Fidelity or Vanguard has the advantages of large fund, with lower trading costs and research expense, and these funds are not differentiated from independently operated small funds in this analysis. The differences in coefficients for small and large funds are summarized below:

Differences in Coefficients, Cross Sectional Regressions

| | **High Quality Funds** | | | | **High Yield Funds** | | |
|---|---|---|---|---|---|---|---|
| | *Large* | *Small* | *Difference* | | *Large* | *Small* | *Difference* |
| *Gt* | -0.04 | -0.06 | 0.02 | *Gt* | 0.42 | 0.45 | -0.03 |
| *Gt-1* | -0.04 | -0.03 | -0.01 | *Gt-1* | -0.29 | -0.32 | 0.03 |
| *Gt-2* | 0.01 | 0.01 | 0.00 | *Gt-2* | -0.47 | -0.49 | 0.02 |
| *It* | -0.13 | -0.12 | -0.01 | *It* | 0.17 | 0.11 | 0.06 |
| *It-1* | -0.02 | -0.01 | 0.00 | *It-1* | -0.79 | -0.48 | -0.30 |
| *It-2* | -0.03 | 0.02 | -0.05 | *It-2* | -0.43 | -0.38 | -0.04 |
| *RSt* | 0.03 | 0.01 | 0.02 | *RSt* | 0.21 | 0.19 | 0.02 |
| *RBt* | 0.97 | 0.90 | 0.07 | *RBt* | 0.76 | 0.75 | 0.01 |
| *TR* | 0.02 | -0.03 | 0.05 | *TR* | 0.40 | 0.37 | 0.03 |
| *DR* | 0.10 | -0.07 | 0.17 | *DR* | 1.70 | 1.54 | 0.16 |
| *EXP* | -0.15 | -0.09 | -0.06 | *EXP* | -0.27 | -0.16 | -0.11 |

The results of the time series regressions (see Table III. Time Series Regression Results) do not have the same level of significance as the cross sectionals, but do reaffirm many of the results. Though statistical significance is lacking, the coefficients of the lagged economic growth and lagged inflation match those of the cross sectional regressions. The overall importance of bond and stock index returns in explaining fund performance, again with a high level of significance, receives further support. A similar result can be seen for default risk

and maturity risk variables.  Finally, though not definitive, the results suggest that small fund performance improves as assets increase, while large fund performance experiences a mild decline.

As with the cross sectional approach, the time series regressions show that the performance of the bond index is again the driving factor behind the performance of all

**Table III. Time Series Regression Results**

| **Large BQ** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Mean Coeff.* | 0.00 | -0.04 | -0.03 | 0.05 | -0.14 | 0.00 | -0.03 | 0.02 | 0.98 | -0.01 | 0.05 | -0.0011 |
| *Std. Dev.* | 0.04 | 0.09 | 0.08 | 0.12 | 0.20 | 0.19 | 0.19 | 0.02 | 0.28 | 0.07 | 0.20 | 0.0119 |
| *Mean t Stat* | 1.32 | 0.75 | 0.72 | 1.20 | 1.17 | 0.56 | 0.90 | 2.44 | 12.75 | 1.42 | 2.12 | 1.41 |
| *Mean p value* | 0.32 | 0.51 | 0.53 | 0.33 | 0.35 | 0.62 | 0.44 | 0.12 | 0.00 | 0.41 | 0.27 | 0.16 |
| **Small BQ** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
| *Mean Coeff.* | 0.00 | -0.05 | -0.04 | 0.03 | -0.14 | 0.01 | 0.02 | 0.01 | 0.91 | -0.02 | -0.06 | 0.0008 |
| *Std. Dev.* | 0.00 | 0.10 | 0.10 | 0.08 | 0.22 | 0.14 | 0.16 | 0.02 | 0.19 | 0.07 | 0.12 | 0.0037 |
| *Mean t Stat* | 1.02 | 0.78 | 0.89 | 0.82 | 1.04 | 0.82 | 0.70 | 1.52 | 12.28 | 2.16 | 2.22 | 1.30 |
| *Mean p value* | 0.46 | 0.52 | 0.45 | 0.47 | 0.41 | 0.48 | 0.55 | 0.31 | 0.00 | 0.17 | 0.18 | 0.19 |
| **All BQ** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
| *Mean Coeff.* | 0.00 | -0.05 | -0.03 | 0.04 | -0.14 | 0.01 | -0.01 | 0.01 | 0.95 | -0.01 | 0.00 | -0.0001 |
| *Std. Dev.* | 0.02 | 0.09 | 0.09 | 0.10 | 0.21 | 0.17 | 0.18 | 0.02 | 0.24 | 0.07 | 0.17 | 0.0087 |
| *Mean t Stat* | 1.17 | 0.77 | 0.81 | 1.01 | 1.10 | 0.69 | 0.80 | 1.97 | 12.51 | 1.79 | 2.17 | 1.35 |
| *Mean p value* | 0.39 | 0.51 | 0.49 | 0.40 | 0.38 | 0.55 | 0.49 | 0.22 | 0.00 | 0.29 | 0.22 | 0.17 |
| **Large BY** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
| *Mean Coeff.* | 0.03 | 0.58 | -0.03 | -0.27 | 0.00 | -0.66 | -0.64 | 0.22 | 0.89 | 0.38 | 1.78 | -0.0139 |
| *Std. Dev.* | 0.15 | 0.33 | 0.37 | 0.40 | 0.41 | 0.54 | 0.56 | 0.06 | 0.38 | 0.12 | 0.36 | 0.0509 |
| *Mean t Stat* | 1.35 | 0.83 | 0.53 | 0.65 | 0.26 | 0.59 | 0.62 | 3.86 | 1.50 | 1.61 | 4.32 | 1.36 |
| *Mean p value* | 0.31 | 0.45 | 0.63 | 0.55 | 0.80 | 0.58 | 0.56 | 0.00 | 0.21 | 0.14 | 0.00 | 0.17 |
| **Small BY** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
| *Mean Coeff.* | -0.03 | 0.53 | -0.21 | -0.30 | 0.08 | -0.66 | -0.51 | 0.19 | 0.89 | 0.37 | 1.67 | 0.0130 |
| *Std. Dev.* | 0.06 | 0.48 | 0.52 | 0.50 | 0.54 | 0.63 | 0.65 | 0.05 | 0.52 | 0.13 | 0.43 | 0.0364 |
| *Mean t Stat* | 1.27 | 0.92 | 0.75 | 0.70 | 0.38 | 0.70 | 0.68 | 3.53 | 1.58 | 1.66 | 4.25 | 1.36 |
| *Mean p value* | 0.37 | 0.42 | 0.50 | 0.54 | 0.73 | 0.52 | 0.54 | 0.01 | 0.25 | 0.14 | 0.00 | 0.22 |
| **All BY** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
| *Mean Coeff.* | -0.01 | 0.56 | -0.12 | -0.27 | 0.04 | -0.66 | -0.59 | 0.20 | 0.90 | 0.38 | 1.73 | 0.0026 |
| *Std. Dev.* | 0.14 | 0.41 | 0.45 | 0.46 | 0.47 | 0.58 | 0.60 | 0.06 | 0.45 | 0.12 | 0.39 | 0.0521 |
| *Mean t Stat* | 1.30 | 0.88 | 0.63 | 0.68 | 0.32 | 0.66 | 0.65 | 3.69 | 1.53 | 1.64 | 4.29 | 1.35 |
| *Mean p value* | 0.34 | 0.43 | 0.57 | 0.54 | 0.77 | 0.54 | 0.56 | 0.01 | 0.23 | 0.13 | 0.00 | 0.20 |
| **All Small** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
| *Mean Coeff.* | -0.01 | 0.23 | -0.12 | -0.13 | -0.03 | -0.31 | -0.24 | 0.10 | 0.90 | 0.17 | 0.78 | 0.0067 |
| *Std. Dev.* | 0.04 | 0.45 | 0.37 | 0.39 | 0.42 | 0.56 | 0.54 | 0.10 | 0.38 | 0.22 | 0.93 | 0.0259 |
| *Mean t Stat* | 1.14 | 0.85 | 0.82 | 0.76 | 0.72 | 0.76 | 0.69 | 2.49 | 7.12 | 1.92 | 3.20 | 1.51 |
| *Mean p value* | 0.42 | 0.47 | 0.48 | 0.51 | 0.56 | 0.50 | 0.55 | 0.17 | 0.12 | 0.15 | 0.09 | 0.18 |
| **All Large** | *Intercept* | *Gt* | *Gt-1* | *Gt-2* | *It* | *It-1* | *It-2* | *RSt* | *RBt* | *MRP* | *DR* | *logTNA* |
| *Mean Coeff.* | 0.01 | 0.29 | -0.03 | -0.10 | -0.06 | -0.35 | -0.36 | 0.12 | 0.94 | 0.19 | 0.96 | -0.0047 |
| *Std. Dev.* | 0.14 | 0.40 | 0.27 | 0.35 | 0.33 | 0.53 | 0.53 | 0.11 | 0.34 | 0.22 | 0.92 | 0.04573 |
| *Mean t Stat* | 1.32 | 0.80 | 0.61 | 0.92 | 0.69 | 0.59 | 0.75 | 3.17 | 6.82 | 1.53 | 3.28 | 1.37 |
| *Mean p value* | 0.32 | 0.47 | 0.58 | 0.44 | 0.58 | 0.59 | 0.51 | 0.06 | 0.11 | 0.26 | 0.13 | 0.16 |

funds. The coefficients for high yield funds remain lower, but the difference is less pronounced. Again, the difference in coefficients for small and large high quality funds

is significant, with no difference between coefficients the same for small and large high yield funds. A nearly identical trend exists for coefficients of the stock market return variable. Default risk premium show similar trends to the cross sectional approach, with large funds again having higher coefficients, though the time series analysis suggests that maturity risk does not affect small funds differently than large funds.

In addition to supporting the results of the previous test, the time series analysis does suggest a positive relationship between TNA and performance for small funds, and a negative relationship for large funds. This would be consistent with the findings of Chen et al (2004), who find a negative relationship between performance and fund size. The improvement in small fund performance coincides with the idea that there is an optimal scale for mutual funds that balances the benefits of economies of scale with the costs associated with reduced liquidity. This relationship, however, is somewhat questionable given the borderline t-stats and p-values for the regression. Differences in coefficients for small and large funds are summarized below:

Differences in Coefficients, Time Series Regressions

| | High Quality Funds | | | | High Yield Funds | | |
|---|---|---|---|---|---|---|---|
| | *Large* | *Small* | *Difference* | | *Large* | *Small* | *Difference* |
| *Gt* | -0.04 | -0.05 | 0.02 | *Gt* | 0.58 | 0.53 | 0.06 |
| *Gt-1* | -0.03 | -0.04 | 0.01 | *Gt-1* | -0.03 | -0.21 | 0.18 |
| *Gt-2* | 0.05 | 0.03 | 0.03 | *Gt-2* | -0.27 | -0.30 | 0.03 |
| *It* | -0.14 | -0.14 | -0.01 | *It* | 0.00 | 0.08 | -0.08 |
| *It-1* | 0.00 | 0.01 | -0.02 | *It-1* | -0.66 | -0.66 | 0.00 |
| *It-2* | -0.03 | 0.02 | -0.06 | *It-2* | -0.64 | -0.51 | -0.13 |
| *RSt* | 0.02 | 0.01 | 0.01 | *RSt* | 0.22 | 0.19 | 0.03 |
| *RBt* | 0.98 | 0.91 | 0.07 | *RBt* | 0.89 | 0.89 | 0.00 |
| *MRP* | -0.01 | -0.02 | 0.00 | *MRP* | 0.38 | 0.37 | 0.01 |
| *DR* | 0.05 | -0.06 | 0.11 | *DR* | 1.78 | 1.67 | 0.11 |
| *logTNA* | -0.0011 | 0.0008 | -0.0019 | *logTNA* | -0.0139 | 0.0130 | -0.0269 |

## VII. Conclusions

Using cross sectional and time series regressions, several variables found important to equity fund performance and individual bond performance are tested with a set of high quality and high yield bond funds of various sizes. It is found that the majority of a bond fund's return can be explained by economic variables. Expenses negatively affect performance for all fund categories examined, but other fund specific characteristics do not appear to significantly impact returns.

The differences between high yield and high quality fund performance are also examined. In general, high yield funds are better explained by economic variables, while a significant amount of the variation in high quality fund returns are explained by index returns. Potential reasons for these differences across investment category are discussed. While the results are not unexpected, they do provide insight into how one may choose to invest in debt instruments. As high quality fund returns show such a strong correlation to the indices, and also

see a negative impact on returns due to expenses, it suggests individual investors might best invest in corporate bonds by simply choosing a broad index fund. Since high yield fund returns are not as easy to explain, however, mutual funds may still prove the best entry into this investment class for individuals.

Although total net assets is not significant as a variable, performance differences exist between the small and large fund groups. Large funds are shown to be more sensitive to maturity and default risk. Also, somewhat surprisingly, expenses are shown to have a greater impact on the returns of large funds than of small funds. Additionally, while somewhat dubious, there is still evidence that suggests return benefits to increasing assets in small funds and declining returns as assets grow in large funds. Finding the appropriate scale to balance the benefits and costs associated with scale is a key microeconomic question with the potential to significantly impact the structure of the mutual fund industry and how individuals invest. Thus, while the findings of this study are in some ways limited, they do identify key questions for further research.

Reference:

Blake, Christopher R.; Elton, Edwin J.; Gruber, Martin J. (1993). The Performance of
Bond Mutual Funds. The Journal of Business. Vol. 66. pp. 371-403.

Carhart, Mark M. (1997). On Persistence in Mutual Fund Performance. The Journal of
Finance. Vol. 52. pp. 57-82.

Chen, Joseph; Hong, Harrison; Huang, Ming; Kubik, Jeffrey D.; Does Fund Size Erode
Mutual Fund Performance? The Role of Liquidity and Organization. American
Economic Review. Vol. 94. pp. 1276-1302.

Cornell, Bradford; Green, Kevin. (1991). The Investment Performance of Low-Grade
Bond Funds. Vol. 46. pp. 29-48.

Elton, Edwin J.; Gruber, Martin J.; Blake, Christopher R. (1995). Fundamental Economic

Variables, Expected Returns, and Bond Fund Performance. The Journal of Finance. Vol. 50. pp. 1229-1256.

Elton, Edwin J.; Gruber, Martin J.; Nabar, P. (1988). Bond returns, immunization, and the return-generating process. In Studies in Banking and Finance, Essays in Memory of Irvin Friend. New York: North Holland.

Golec, J. H. (1996). The effects of fund managers' characteristics on their portfolio performance, risk, and fees. Financial Services Review. Vol. 5. pp. 133-148.

Grinblatt, Mark; Titman, Sheridan. (1989). Mutual fund performance: An analysis of quarterly portfolio holdings. Journal of Business. Vol. 62. pp. 393-416.

Grinblatt, Mark; Titman, Sheridan. (1992). The Persistence of Mutual Fund Performance. The Journal of Finance. Vol. 47. pp. 1977-1984.

Grinblatt, Mark; Titman, Sheridan. (1994). A Study of Monthly Mutual Fund Returns and Performance Evaluation Techniques. The Journal of Financial and Quantitative Analysis. Vol. 29. pp. 419-444.

Gruber, Martin J. (1996). Another Puzzle: The Growth in Actively Managed Mutual Funds. Journal of Finance. Vol. 51. pp. 783-810.

Ibbotson, R. G.; Patel, A. K. (2002). Do winners repeat with style? Yale ICF Working Paper 00-70. Yale University.

Ippolito, R. A. (1989). Efficiency with costly information: A study of mutual fund performance, 1965-84. Quarterly Journal of Economics. Vol. 104. pp. 1-23.

Jensen, M.C. (1968). The performance of mutual funds in the period of 1945-1964. The Journal of Finance. Vol. 23. pp. 16-26.

Prather, Laurie; Bertin, William J.; Henker, Thomas. (2004). Mutual fund characteristics, managerial attributes, and fund performance. Review of Financial Economics.

Vol. 13. pp. 305-326.

Roll, Richard; Ross, Stephen. (1980). An empirical investigation of the arbitrage pricing
theory. Journal of Finance. Vol. 35. pp. 1073-1103.

Sharpe, W. F. (1966). Mutual Fund Performance. Journal of Business. Vol. 39.
pp. 119-138

Treynor, J. L. (1965). How to rate management of investment funds. Harvard Business
Review. pp. 63-75.

Wermers, Russ. (2000). Mutual Fund Performance: An Empirical Decomposition into
Stock-Picking Talent, Style, Transaction Costs, and Expenses. The Journal of
Finance. Vol. 55. pp. 1655-1695.