Controlling for Fixed Income Exposure in Portfolio Evaluation: Evidence from Hybrid Mutual Funds

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Abstract

We examine whether explicitly controlling for the fixed income exposure of mutual funds affects conclusions drawn in performance assessment. We focus on daily return data from two hybrid mutual fund samples. Comparing abnormal performance estimates from the Carhart (1997) model to extensions designed to correct for bond holdings, we find that the estimates within one of our samples change from positive to significantly negative. Additional evidence indicates that cash flows to the funds are more closely correlated with the traditional Carhart measure, clearly indicating that the absence of bond indices misleads investors who use a fund's risk adjusted performance as the basis for investment decisions.

The four factor model of Carhart (1997) is widely accepted by academic researchers for measuring the abnormal performance of equity fund managers. The model is designed to explain equity returns and to measure the abnormal return generated from picking stocks that outperform the benchmark on a risk adjusted basis. Because its focus is on equity fund performance, no bond indices or factors are explicitly included as part of the model. However, an examination of reported asset allocation data indicates that fixed income securities compose a nontrivial percentage of the holdings of equity mutual funds and a substantial portion of the assets held by hybrid funds.

Using the December Morningstar Principia Pro CDs for the years 2001 through 2005, we collect portfolio weight data for the four categories of equity funds and two categories of hybrid funds frequently included in performance studies. Across the five years, an average of 37% of equity income funds, 22% of growth and income funds, 13% of aggressive growth funds, and 10% of growth funds hold bonds as part of their portfolio. Nearly all balanced funds and over 78% of asset allocation funds include debt in their portfolios. The average fixed income allocation of those funds reporting bond holdings ranges from 3.4% (aggressive growth) to 34.7% (balanced).

These reported portfolio data raise the following issue which serves as the focus of our study: does the Carhart model sufficiently account for the returns from various fixed income securities so that conclusions drawn in performance evaluation are not sensitive to the percentage, credit quality, or average maturity of fixed income holdings within a mutual fund's portfolio? Accounting for bond holdings was first raised by Elton, Gruber, Das, and Hlvaka (1993). Prior to the development of the Carhart model, they demonstrate that returns on S&P stocks, non-S&P stocks, and bonds are significant factors in the performance assessment of equity funds. However, they conclude that the impact of bond holdings on the estimated abnormal return of equity funds is negligible over the 1965-1984 period.

In this study, we revisit this issue but instead focus on evaluating hybrid mutual funds. We focus on this class of funds for several reasons. First, previous work that examines the performance of hybrid funds typically includes these funds as part of the equity fund sample and applies asset pricing models designed explicitly for equity funds despite the fact that hybrid funds typically hold debt in their portfolios.[1] Second, as a result of the bear market in stocks during the early part of the decade, these funds have become popular investment vehicles. According to data from the Investment Company Institute, total annual net new cash flow into hybrid funds outpaced that of equity funds for the first time ever in 2002 and outpaced cash flow into bond funds both in 2003 and 2004. At the end of 2004, over $500 billion was invested in these funds. Third, performance measures provided by Morningstar suggest that managers of hybrid funds generate substantial value for investors. As of the end of 2005, Morningstar reports a positive abnormal return for over 75% of hybrid funds as measured by the alpha from Sharpe's (1964) single factor CAPM.[2]

In this study, we use daily fund return data to measure the abnormal return earned by hybrid fund managers.[3] First, based on available portfolio information, we propose extensions to the Carhart model that would be appropriate to measure the performance of a fund that holds both stocks and bonds. Then, we measure abnormal return in two ways. First, we estimate the intercept of the factor models, which is generally referred to as the fund's alpha. Based on evidence that these funds also engage in timing behavior, we estimate a second measure of abnormal return suggested by Bollen and Busse (2004), which combines both the manager's asset selection and market timing performance. Our goal is to compare the conclusions we draw about performance from the Carhart model and the extended forms of the model.

Using Morningstar fund classifications, we examine the performance of two hybrid fund samples. One sample of funds covers March 1994 to December 2000. The other sample covers the period January 2001 to June 2005. We partition the sample in this manner due to data issues that are detailed in the next section. We find that the extended forms of the Carhart model provide substantially different conclusions concerning the abnormal performance of the hybrid funds as measured by both alpha and the Bollen and Busse (hereafter referred to as BB) measure. In our 1994 sample, there is an improvement in estimated performance when using the extended models although average performance remains negative. In the 2001 sample, performance is initially positive according to the Carhart model but is negative and statistically significant according to the extended models. These changes in estimated performance are directly related to changes in the relationship between bond returns and the factors in the Carhart model. Our evidence indicates that the Carhart model is not well suited for explaining variation in bond returns. Specifically, over our 2001 sample period, managers are positively rewarded by the Carhart model simply for holding bonds regardless of the manager's skill level. Once we control for these holdings, abnormal performance becomes negative.

These results lead us to explore two additional issues. The academic literature on equity fund cash flows indicates that investors chase past positive abnormal returns (see for example Gruber 1996; Chevalier and Ellison 1997; Sirri and Tufano 1998; DelGuercio and Tkac 2002). We test for and find evidence that new cash flows to hybrid funds are also correlated with past estimates of abnormal performance. As a result, the difference across our performance measures raises the issue of whether investors are properly controlling for fund fixed income exposure in their investment decisions. Across both samples, our results indicate that hybrid fund cash flows are most strongly correlated with the traditional Carhart alpha, clearly indicating that the absence of bond indices misleads investors who use a fund's risk adjusted performance as the basis for investment decisions. Thus, a significant amount of investment dollars are flowing into funds that according to the Carhart model have positive risk adjusted performance but have negative performance once we control for the fund's bond holdings. Overall, the results of our study emphasize the importance of controlling for fixed income exposure and motivate the use of bond indices in performance evaluation when portfolio data indicate that funds hold a substantial proportion of fixed income securities.

The paper is organized as follows. Section 1 provides a description of the fund sample. Section 2 introduces the empirical models used to measure abnormal return. Sections 3 and 4 provide empirical results focusing on the estimates of abnormal performance across the models. Section 5 focuses on the economic value of our results. Section 6 examines the relationship between our abnormal return estimates and subsequent cash flows to the funds. Section 7 concludes.

1. Fund Sample

Using simulated funds and monthly return data, Kothari and Warner (2001) demonstrate that standard performance measures used in mutual fund research have little ability to detect large magnitudes of abnormal fund performance. Similarly, Goetzmann, Ingersoll, and Ivkovic (2000) and Bollen and Busse (2001) indicate that conclusions concerning portfolio performance, specifically market timing ability, are sensitive to data frequency. The conclusion of the Bollen and Busse study is that model power is improved with higher frequency data.

These results, combined with the fact that the extended forms of the Carhart model to be presented later in this study include eight factors, motivate the use of daily return data in our study. We construct fund samples for which daily net asset value and distribution data are publicly available. This allows us to create a daily return series for each fund as follows:

$$r_{p,d} = \frac{nav_{p,d} + div_{p,d}}{nav_{p,d-1}} - 1 \qquad (1)$$

where

$nav_{p,d}$ = net asset value of fund p on day d

$div_{p,d}$ = ex div dividends of fund p on day d

We create two separate hybrid fund samples. For both samples, our selection of funds is based on the fund's Morningstar classification. Morningstar defines asset allocation funds as funds that hold a flexible combination of stocks, bonds, and cash. These funds shift assets frequently based on analysis of business-cycle trends with the dual goal of income generation and capital appreciation. Balanced funds are defined as funds that seek both income and capital appreciation by investing in a generally fixed combination of stocks and bonds. In general, balanced funds hold a minimum of 25% of their assets in fixed income or cash securities at all times.

We have access to two separate sources of daily mutual fund data, and our samples are partitioned such that within each sample the data is exclusively collected from the specific data source. Net asset value and distribution data for the first sample come from Bloomberg, which obtains data from the National Association of Security Dealers. Beginning in January 2001, the Center for Research in Security Prices (CRSP), which is the primary source of monthly fund data for most academic studies, began to provide daily fund data which is less prone to error. The second sample uses this data source. There are two advantages to using the separate samples.

Given the growth in the number of hybrid funds, our second sample provides us with a greater number of funds to examine over a time period when these funds surged in popularity. Second, we can test the robustness of our results across the two samples and see whether our results are applicable to each sample.

The first sample is based on hybrid funds in existence as of December 31, 1993. Very limited portfolio data are available on these funds. To ensure that our results are not biased by funds with an international focus, we eliminate any fund with the words 'global', 'world', or 'international' in the fund name. For fund groups with multiple classes of the same fund, we average the fund returns across the multiple fund classes to create one fund that is a part of our sample since the management strategies and returns generated are identical across classes.

The daily return data cover the period March 1, 1994 to December 31, 2000. The start date is motivated by the earliest availability of daily bond return indices that are necessary for the extended Carhart models. Our sample is constructed such that it is free from both look ahead and survivorship bias. Because we are using daily data to estimate performance, we do not need to impose a minimum survival period to have sufficient data to estimate the model parameters. Once included in the sample, all funds remain in the sample until the end of the time period or until they cease operations.

For this sample, accuracy of the daily return series is extremely important.[4] We identify questionable data points by examining the tails of the daily cross section distribution of fund returns. Similar to Busse (1999), we verify questionable net asset values against data provided by *Yahoo Finance* and the *Wall Street Journal*. Questionable distributions are verified using either the *Standard and Poor's Annual Dividend Record* or *Moody's Dividend Record*. In a small number of cases, daily net asset value or distribution data are missing for a specific fund and are not available from any of these data sources. Under these circumstances, we estimate the missing return for that day as follows: 1) we calculate the daily return of the typical hybrid fund benchmark which is weighted 60% CRSP value weighted index and 40% Lehman Aggregate Bond index, 2) for the five trading days preceding the missing return, we calculate the average difference between the fund return and the benchmark return, and 3) we estimate the missing return as the sum of the benchmark return on the missing day and the average difference between the fund return and the benchmark over the preceding five trading days.

The second sample is composed of asset allocation and balanced funds in existence as of December 31, 2000, and the return data covers the time period January 1, 2001 to June 30, 2005. Over this period, Morningstar provides more detailed information about hybrid funds, and we are able to explicitly control for internationally focused funds by limiting the sample to funds classified as domestic hybrid funds.[5] Similar to the earlier sample, this sample does not suffer from look ahead nor survivorship bias. In addition, because the data are from CRSP, we do not encounter the same data issues as discussed previously.

The 1994 sample is composed of 132 funds, while the 2001 sample features 263 funds reflecting the growth in hybrid funds since 1994. Table 1 presents descriptive statistics of the fund samples. All data are annual data from CRSP and represent year end data.[6] To obtain the averages reported in the table, we first average over the time series for each fund and then average across funds.

Despite the growth in the number of hybrid funds, there are no substantial differences in the attributes of the funds that would potentially drive any differences in empirical results across the two samples. Median size ($149 million for the 1994 sample vs. $124 million for the 2001 sample), expense ratio (1.14% vs. 1.04%), and portfolio turnover (98.7% vs. 91.8%) are roughly similar across the samples. In addition, there are no substantial changes in the average allocation strategy pursued by each sample of funds despite the fact that bonds outperformed stocks during the latter sample period. The average bond investment (29.8% vs. 29.5%) is nearly identical and is not driven by outliers (median 32.1% vs. 32.3%). These similarities are not simply a reflection of the same funds representing the majority of both samples given the continuous sample periods. Only 77 of the funds from the 1994 sample are included in the 2001 sample.

Overall, the reported data indicate the major role that bonds play within the portfolios of both of our fund samples, so we turn to a discussion of controlling for the fixed income exposure of these funds when evaluating their performance.

2. Empirical Models Used to Measure Abnormal Return

As discussed in the previous sections, our goal is to compare estimated fund performance from the Carhart model to extensions of the model that explicitly control for the fixed income holdings of hybrid funds. The Carhart model is

$$r_{p,d} = \alpha_p + \sum_{s=1}^{4} b_{ps} r_{s,d} + e_{p,d} \tag{2}$$

where $r_{p,d}$ is the excess return of fund p on day d, and $r_{s,d}$ represents the daily returns of the following four stock market factors: 1) the excess return of the market portfolio, 2) the Fama French (1993) size factor, 3) the Fama French (1993) book to market factor, and 4) the Carhart momentum factor. The intercept of the model, α_p, represents the daily abnormal return earned by the manager.

Carhart's model captures the major anomalies of the CAPM and explains a considerable portion of the variation in equity returns. Unfortunately, much less work has been done on the appropriate models to explain the returns generated by bond mutual funds. Fama and French

(1993) demonstrate that factors related to bond maturity and default risk capture most of the variation in the returns of government and corporate bond portfolios. Both Sharpe (1992) and Blake, Elton, and Gruber (1993) propose various models that use bond indices to explain the returns of bond funds. Ferson, Henry, and Kisgen (2005) use the stochastic discount factor approach, which unlike the previously mentioned studies, does not require the use of indices or factor mimicking portfolios. Most recently, Comer (2006) develops a four index bond model that includes indices that represent high quality bonds, low quality bonds, long maturity bonds, and short maturity bonds to explain the bond portion of hybrid fund portfolios though more research is needed concerning the validity of the model.

We choose to extend the Carhart model using the portfolio approach of Blake et al. (1993) and Comer (2006) given the recent increase in both the availability of fund portfolio data and bond indices designed to measure the performance of various bond market sectors. In general, the goal of the portfolio approach is to choose indices that span the investment opportunity set of a typical bond fund manager. Given that bonds are classified by type and maturity, we develop two extensions of the Carhart model based on portfolio data provided by Morningstar. Our extensions of the model take the general form

$$r_{p,d} = \alpha_p + \sum_{s=1}^{4} b_{ps} r_{s,d} + \sum_{b=1}^{4} b_{pb} r_{b,d} + e_{p,d} \quad (3)$$

where $r_{b,d}$ represents the daily excess returns to a set of bond indices.

At issue is the appropriate choice of bond indices to control for the fixed income holdings of the funds. Beginning in 2005, Morningstar provides a history of the annual investment weights by fixed income sector for funds currently in existence that hold bonds as part of their portfolios. Morningstar obtains this portfolio data from voluntary surveys returned by the mutual funds within its database. From the 2001 sample, 229 of the 263 funds survived to 2005, and

198 of the survivors (86.5%) provide this annual data to Morningstar. The data indicate that the bond investment for hybrid funds spans all of the major sectors of the fixed income market. According to data from the reporting funds, the average percentage of total bond investment in each sector is 36.6% credit, 23.9% government, 19.4% cash, 17.7% mortgage, and 2.4% foreign. These numbers are not influenced by outliers as the median percentages are nearly identical to the mean.

Based on this data, our first extension of the Carhart model includes the daily excess returns from the following four sector bond indices: 1) government, 2) credit, 3) mortgage, and 4) high yield. We exclude the foreign sector in the interest of parsimony given its low average weight as reported by the funds and given our initial fund screening that restricts our sample to hybrid funds with a domestic focus. Despite not having specific data on high yield exposure, we include a high yield index for two reasons. First, six funds in the sample explicitly report a fixed income style classified as low quality. Second, Comer (2006) uses Sharpe's (1992) style analysis to explain the variation in returns across his hybrid fund samples and finds that the funds have a small but statistically significant exposure to a high yield bond index. We will refer to this first extension as the Carhart sector (C-sector) model.

Morningstar also reports an annual fixed income style based on the average maturity or duration of the funds' bond holdings. These styles are based on self reported data, or in some cases, direct observation of the fund portfolio. From the 2001 sample, 185 of the funds voluntarily provide at least one fixed income style classification during the sample period. Among these funds, 34 funds can be classified as short maturity funds, 136 as intermediate maturity funds, and 15 as long maturity funds.[7] We propose a second version of equation (3) where the sector daily excess returns from the government and credit indices are replaced by daily excess returns from the intermediate maturity government/credit index and the long maturity government/credit index. The mortgage and high yield indices remain in the model, and we refer to this model as the Carhart maturity (C-maturity) model.[8] We do not include a short maturity index, as the returns from such an index are highly correlated with the returns to cash.

All of the bond indices used in the extensions of the model are daily indices from Lehman Brothers and measure total return. We use the daily risk free rate as calculated by Busse (1999) to calculate excess returns. The Lehman Brothers indices are the most comprehensive market weighted indices available and the most widely used family of indices in bond portfolio evaluation. Daily bond index return data for the indices used in the model are available from Lehman Brothers beginning March 1, 1994 except for the high yield index. Daily high yield data is available beginning June 1, 1998. Before this date, we calculate the fixed daily high yield return that corresponds to the reported monthly return and use that return in our models.

At issue is whether the extensions effectively represent the return generating process of hybrid funds. More specifically, we want to test whether the funds have significant exposure to the indices included in the extended Carhart models. We follow the methodology of Comer (2006) and employ Sharpe's (1992) quadratic programming technique. Sharpe's methodology is designed to determine the average exposure of a portfolio to movement in the returns of various stock, bond, and cash indices. For each fund sample, we average the fund returns for all funds in existence on a given day. Using this time series of average returns, we solve the following quadratic program:

$$\min \left[\text{var}\left(tr_{p,d} - \left(b_{pm} tr_{m,d} + \sum_{s=1}^{3} b_{ps} r_{s,d} + \sum_{b=1}^{4} b_{pb} tr_{b,d} + b_{pc} tr_{c,d} \right)\right)\right]$$

$$\textit{subject to} \qquad (4)$$

$$0 \le b_{pm}, b_{pb}, b_{pc} \le 1$$

$$b_{pm} + \sum_{b=1}^{4} b_{pb} + b_{pc} = 1$$

where *tr* represents the total return as opposed to the excess return. Thus, $tr_{m,d}$, $tr_{b,d}$, and $tr_{c,d}$ represent the daily total return to the Carhart market factor, the bond factors and cash (the risk free return) respectively. Traditionally, Sharpe's methodology restricts all coefficients to values between zero and one, but note that we only restrict the coefficients for the Carhart market factor, the bond indices, and the cash index. The remaining three stock factors in the Carhart model represent zero investment factor mimicking portfolios. As a result, the amount held in these portfolios does not affect the allocation of funds across the other portfolios.

Results are reported in Table 2.[9] They provide strong evidence that the extended models capture much of the variation in hybrid fund returns despite the constraints imposed by the quadratic programming method. The results also provide our first indication of the potential importance of controlling for the fixed income exposure of hybrid funds. Across both samples and both models, the regressions explain an average of 98.8% of the variation in the average returns of these funds. Each of the included bond indices has a statistically significant nonzero coefficient across the four regressions except for the credit index in the 1994 sample.[10] Results are particularly strong for the 2001 sample. Across both models, all coefficients for the bond indices are significant at the one percent level. There does not appear to be any major differences in the results across the C-sector and C-maturity models that would raise concerns with the use of either model. Both models indicate average bond exposures ranging from 31.8%

to 35.0% and confirm the portfolio data from the previous section which indicate that these funds hold a wide variety of bonds across sectors and maturities.

In the next section, using our proposed extensions of the Carhart model, we focus on establishing the importance of controlling for fund fixed income exposure.

3. Impact of Fixed Income Holdings on Abnormal Return Estimates

Our proposed extensions of the Carhart model are based on portfolio data provided by Morningstar. However, despite the fact that the models explain a substantial portion of the variation in hybrid fund returns, we need to address whether these extended models are truly necessary. Econometrically, the Carhart model or an extended model which includes only a broad aggregate bond index would be preferable. Thus, we need to examine whether there is substantial evidence that abnormal return estimates from more parsimonious models may be biased due to the exclusion of the bond indices proposed in our extended models. We now turn to exploring this issue.

3.1 Effect of Bond Returns on Estimates of Abnormal Return from the Carhart Model

A fund's abnormal return is a weighted average of the abnormal returns on the individual assets that compose the portfolio. To see the potential effect of an excluded asset class on the estimated abnormal returns from the Carhart model, we need to estimate the abnormal return of that asset class. Thus, we follow the methodology used by Elton et al (1993) to examine the impact of bond holdings on the abnormal returns from the Carhart model.

Based on the style analysis from the previous section, we assume that the bond indices are reasonable proxies of the bond holdings of hybrid funds. As a proxy for the performance of the bond holdings of hybrid funds, we employ the daily returns of the bond indices included in the extended versions of the Carhart model. We then run the following individual regressions for each of our bond indices:

$$r_{b,d} = \alpha_b + \sum_{s=1}^{4} b_{ps} r_{s,d} + e_{b,d} \tag{5}$$

If the Carhart model adequately explains bond returns, α_b should not be significantly different from zero since the bond indices represent passive portfolios and no expenses have been deducted from the index returns. Otherwise, the estimated abnormal return from the Carhart model for a fund that holds a substantial amount of bonds within the specific index would be a function of the "true" alpha and α_b from equation (5). The influence of α_b would depend on the weight of bonds within the fund portfolio and the bond index returns.

Results of the regressions are presented in Table 3. All reported abnormal returns have been annualized. For the 1994 sample, the alphas across the bond indices range from -5.27% to 0.20%, and the alpha for the high yield index is statistically significant at the five percent level. On the other hand, the abnormal return estimates for the 2001 sample are more dramatic. All are positive, statistically significant, and much larger in absolute magnitude relative to the alphas from the 1994 sample. These annualized estimates range from 6.01% to 9.57% with the long maturity government/credit index generating the largest abnormal return.

The regression results indicate that estimates of abnormal return across the Carhart and extended Carhart models are likely to differ. On average, over the period 1994-2000, abnormal return estimates from the Carhart model are likely to be lower than those for the extended models, which control for bond exposure. The exceptions to this would be if the fund has a very low bond exposure or if a substantial portion of the manager's bond holdings are represented by mortgage securities, which is the only index with a positive alpha. Even stronger evidence exists that the abnormal returns from the Carhart model over the 2001-2005 period are likely to be greater than those of the extended models. According to both the reported portfolio data and the style analysis, the average percentage of bond holdings across both samples is relatively constant. Thus, differences in estimated abnormal returns between the Carhart and extended Carhart models are likely to be more significant over the latter period given the greater magnitude and statistical significance of the bond index alphas over that period.[11]

3.2 Is An Aggregate Bond Index Sufficient?

Given the potential bias of abnormal return estimates from the Carhart model, we now examine whether adding a broad aggregate bond index to the Carhart model is sufficient so that we can consider a more parsimonious form of the extended Carhart models suggested in equation (3). This would be particularly useful if only monthly data are available.

We choose the Lehman Brothers Aggregate Bond Index as our broad bond market index. This Lehman index is composed of a weighted average of government, investment grade corporate, mortgage backed, and asset backed securities that have a time to maturity of at least one year. It is considered to be the dominant fixed income benchmark for US money managers. According to Lehman Brothers, 90% of US fixed income index users rely on this index. Using this index, we conduct a similar test to the one in the previous section. We regress each of the bond indices included in both of our proposed models against the Carhart model with the Lehman Aggregate Bond Index as an additional independent variable. This test directly addresses whether we need to include multiple bond indices to control for fixed income exposure.

Results are presented in Table 4. The results indicate that for the 1994 sample the broad index would likely be sufficient to control for fund fixed income exposure, but abnormal return estimates over the 2001 period still could potentially be biased. Over the 1994-2000 period, the bond index alphas estimates are in a narrow range (-0.58% to 0.54%), and none are statistically significant. However, over the period 2001-2005, alphas for the government and high yield index are statistically significant at the one percent level, while alphas for the long maturity government/credit index and the mortgage index are significant at the five percent level. The government and long maturity index alphas are both negative (-0.98% and -2.42%, respectively) reflecting the potential for downward biased estimates relative to the extended models. The opposite impact is likely for funds that hold a substantial amount of mortgage and high yield securities whose alphas are both positive (0.92% and 5.80%, respectively).

Thus, our evidence within this section suggests that our extended models are necessary to reduce the potential for biased estimates of performance that could result from the Carhart model or an extended model that only includes a broad bond market index. The potential for bias is strongest for the 2001 sample. In the next section, we test our hypotheses by estimating and comparing abnormal return estimates across the Carhart and our extended Carhart models.

4. Comparison of Abnormal Return Estimates Across Models

Given the results of the previous section, our goal is to estimate the abnormal returns of our samples of hybrid funds using the Carhart and extended Carhart models and to examine the extent to which the assessment of manager performance differs across the models. We first measure abnormal return as the intercept of the models, which is referred to as the fund's alpha. Then, based on evidence that the funds also engage in timing behavior, we estimate a second abnormal return measure which combines both the manager's asset selection and market timing performance. In calculating abnormal return, we first use the equal weighted time series of average fund returns that was used in the style analysis to estimate an abnormal return for the entire sample. Because we are interested in inferences for individual funds, we also estimate individual abnormal returns across the three models. For all regressions, we correct for potential heteroskedasticity using the White correction, and all statistical inferences are based on the corrected standard errors.

4.1. Abnormal Return as Measured by Alpha

Using equations (2) and (3), we estimate alpha for all three models and across both samples. Results are presented in Table 5 and provide strong evidence that abnormal return estimates are sensitive to the model used to estimate performance. First, we focus on the 1994 sample. According to the Carhart model, the average annualized alpha of the entire sample of hybrid funds is -1.50%, clearly indicating that as a group the funds under perform the benchmark. Individually, 80% of the funds have negative abnormal returns and for 26% of these funds the abnormal return is negative and statistically significant at the five percent level. Abnormal return estimates range from -12.28% to 5.51%.

When examining the results from the C-maturity and C-sector models, we find that the inclusion of the bond indices does result in an improvement in the abnormal return estimates. The average annualized alpha of the entire sample is -1.25% according to the C-maturity model and -1.26% according the C-sector model. Matched pairs t-tests of the difference in individual fund alphas relative to the Carhart model are significant at the one percent level for the C-maturity model and at ten percent for the C-sector model. At the individual level, we find that

62% of the fund alphas from the C-maturity model improve relative to the Carhart model. The percentage is 53% for the C-sector model.

One of our hypotheses from Section 3.1 was that over the 1994-2000 period, abnormal return estimates from the Carhart model are likely to be lower than those for the extended models which control for bond exposure unless a substantial portion of the manager's bond holdings are represented by mortgage securities. To test this hypothesis, we sort the funds into three groups based on whether their alpha improved, remained unchanged, or declined when using the extended models. For each group, we calculate the average loading on the mortgage index from the regressions. The results are consistent with the hypothesis. According to the C-maturity model, the average loading on the mortgage index for the 15 funds whose performance declined was 0.16 while the loading of the other two groups averaged 0.04. Similar results hold for the C-sector model as the average loading for the funds whose performance declined was 0.24 compared to an average of 0.05 for the other groups.

Turning to the 2001 sample, the results are also consistent with our hypothesis and much more dramatic in magnitude relative to the 1994 sample. According to the Carhart model, the average annualized alpha of the entire sample is positive at 0.08% but declines to significantly negative values of -1.52% and -1.50% according to the C-maturity and C-sector models. At the individual fund level, 52% of funds have negative abnormal return measures based on the Carhart model while at least 86% are negative based on the extended models. Only 14 funds have significantly negative performance based on the Carhart model while the number jumps to 89 funds based on the extended models. Matched pairs t-tests of the difference in individual fund alphas relative to the Carhart model are significant at the one percent level for both the C-maturity and C-sector models, and we find that 98% of the fund alphas from the extended models are lower than their corresponding Carhart estimates. Conclusions drawn concerning manager performance clearly differ across the models within this sample with the Carhart model suggesting that managers have skill, particularly pre expenses, while the extended models indicate otherwise.

Of equal importance, the results do not appear to be driven by the choice of the extended model used to measure abnormal performance. The same broad conclusion concerning hybrid fund performance can be drawn from both the C-maturity and C-sector models. The rank correlations between the extended model measures are .998 for the 1994 sample and .975 for the 2001 sample. The absolute change in alpha is also virtually identical across models. For the 1994 sample, there is a 0.25% improvement in alpha when using the C-maturity model compared to a 0.24% improvement according to the C-sector model. The decline in alpha for the 2001 sample is -1.61% for the C-maturity model and -1.58% for the C-sector model. Thus, the results do not appear to be sensitive to the extended model used and do not affect the overall conclusions drawn concerning performance.[12]

A final issue we examine is whether these results are a function of stale pricing which potentially induces autorcorrelation among the returns. Dimson (1979) illustrates that estimated coefficients from asset pricing models, specifically the CAPM, can be biased when an asset is infrequently traded. He proposes the use of lagged values of the market factor to address this issue. This issue is of potential concern in our study given our use of daily returns and the potential that funds may hold illiquid securities.

Following this work, we conduct several tests using lagged values of our stock and bond returns. We reestimate the Carhart model and the extended Carhart models and include one lag for each of the factors in the model.[13] We find that these new results are consistent with our previous results. Just as we found earlier, the alphas for the 1994 sample improve when comparing the Carhart results to the extended model results and the opposite occurs within the 2001 sample as the alphas still change from positive to negative and significant. As an additional test, we examine whether a single bond factor with lags captures the change in alpha we find across models. As our bond factors, we first use the return on Lehman Aggregate Bond Index as an additional independent variable and then we repeat the test using the Lehman Treasury Bond Index. Again, our results confirm that the nonsynchronous trading problem is not driving our results. Specifically, in the 1994 sample, we find that the alphas estimated using the bond factor with a lag are not statistically different from the Carhart alphas but are significantly different from the extended model alphas. In the 2001 sample, the alphas estimated using a single bond factor with a lag do improve relative to the Carhart alphas, but the improvement in performance is less in magnitude than the improvement found when comparing to the extended model alphas.[14]

4.2 Market Timing Activity and Estimated Abnormal Return

Comer (2006) provides evidence that hybrid funds engage in market timing activity. As discussed in Bollen and Busse (2004), our results from the previous section may be subject to a specification problem as we treat all funds as focusing on asset selection when some may engage in market timing.[15] The performance of the market timers may not be recognized by the models previously employed. Unfortunately, we do not have evidence on which funds focus more on asset selection and which focus more on market timing. Thus, we want to account for the potential impact of market timing behavior and examine whether the previous relationships across the models still holds and whether there are any significant differences in abnormal return estimates for a specific model.

To account for market timing activity, we use the quadratic regression approach pioneered by Treynor and Mazuy (1966).[16] Following Bollen and Busse (2001) and Comer (2006), we supplement our Carhart model and our extended Carhart models by including the square of the excess return of the market portfolio as an additional explanatory variable in each model. The quadratic term captures the nonlinearity between daily fund returns and daily market returns that occurs due to the timing activity by the fund manager. Then, following Bollen and Busse (2004), we estimate a daily abnormal return for our fund sample that considers both asset selection and timing ability as:

$$r_{p,d,\gamma} = \frac{1}{n} \sum_{d=1}^{n} \left(\alpha_p + \gamma_p r_{m,d}^2 \right) \tag{6}$$

where n represents the total number of trading days the fund exists over our sample period and γ_p is the coefficient on the quadratic term which measures timing ability. The term in parentheses captures the total abnormal return generated by both asset selection skill (α_p) and market timing activity ($\gamma_p r^2_{m,d}$), and we divide by the number of trading days to estimate a daily abnormal return. We refer to $r_{p,d,\gamma}$ as our BB abnormal return.

As done in the previous section, we estimate the BB abnormal return for the entire sample, and we also estimate individual BB abnormal returns across the three models. Table 6 reports the results for the entire sample and also reports alphas from the earlier tests for comparison.

We find that when we explicitly account for timing activity, the changes in the average abnormal return estimates across models are relatively small, ranging from -.11% to .04%. More importantly, the results confirm the relationships detected in the previous section. For the 1994 sample, the abnormal return estimates from the Carhart BB model indicate worse performance (-1.45%) than the estimates from the extended models (-1.36% and -1.35% for the C-maturity and C-sector BB models respectively). For the 2001 sample, we see a decline in performance as we compare the Carhart BB model to the extended Carhart BB models. The Carhart BB estimate of 0.12% declines to -1.64% and -1.58% according the extended models. Again, the magnitude of the change is much greater for the 2001 sample and represents a statistically significant reduction in estimated performance across model specifications.

These results reinforce our initial findings that the extended factor models produce significantly different abnormal return estimates. In the next section, we examine the economic value of the results from the extended models.

5. Economic Value of the Models

Although the estimates from the extended forms of the Carhart model clearly differ from those of the Carhart model, it is not so clear that adding the bond factors results in a superior model specification. To examine the economic value of the extended forms of the model, we conduct out of sample tests to analyze the forecasting performance of the extended model estimates. Specifically, we test for evidence that the models are effective at predicting future alphas and factor loadings.

We follow the methodology of Gruber (1996) who examines the forecasting performance of various performance measures. Each quarter, we estimate the alpha of each fund that survives for the entire quarter.[17] Then, at the end of each quarter, the funds are ranked and placed into deciles based on the funds' alpha during the quarter. We refer to this initial quarter as the selection period. Next, the alpha of each decile is estimated over the subsequent quarter which we refer to as the performance period. During this period, alphas are computed for each fund separately, and then the alpha for the decile is calculated as the equal weighted average of the individual fund alphas. Finally, we average the time series of alphas for each decile across the performance periods. We can analyze the out of sample performance of the extended models in two ways. First, we can calculate the rank correlation of the deciles in the selection and performance period. Second, we compute the differences in alpha across deciles and test whether they are statistically significant.

Results are presented in Table 7. All alphas reported in the table have been annualized. We find strong evidence that the extended model alphas from a previous quarter provide information about the future abnormal return earned during the subsequent quarter. All of the rank correlations are significant at the one percent level. The differences between the best and worst deciles range from 2.96% to 3.38% and are also significant at the one percent level. Across both models and both samples, funds in decile one (worst alphas) on average perform the worst in the subsequent quarter and funds in decile ten (best alphas) perform the best. Even though a positive abnormal return is unlikely to be earned by purchasing the best decile of funds, an investor clearly would be better off holding the best decile funds than any other decile. Similar results hold when we sort on the BB abnormal return measure instead of alpha.

We repeat our methodology and test for evidence that the extended models are effective at predicting future factor loadings. First, we examine the rank correlations of the loadings on each of the four stock factors in the model. We find that all of the rank correlations for both the C-maturity and C-sector models are one and that the average loadings across deciles for the market, size, book to market, and momentum factors are virtually identical to and statistically indistinguishable from the corresponding loadings for the Carhart model. Then, we examine the correlations for the four bond factors. The average loadings across deciles for both the C-maturity and C-sector models are reported in Table 8 for both samples. Again, we find strong evidence that the factor loadings from a previous quarter provide information about the future factor loadings for the subsequent quarter. All rank correlations are statistically significant at the one percent level except for the corporate factor in the 1994 sample and the mortgage factor in the C-maturity model for the 2001 sample which are significant at the five percent level.

Overall, the evidence indicates that both the C-maturity and C-sector models work well out of sample and provide information about future performance and factor loadings. Our evidence also shows that the loadings on the stock factors can be predicted equally well whether one uses the Carhart or the extended Carhart models. Taken together, the results reinforce that the difference in alpha estimates across the Carhart and extended Carhart models is simply a function of a fund's bond holdings. Thus, to avoid punishing or rewarding hybrid fund managers simply for holding debt in their portfolios, the extended models should be the preferred choice for portfolio evaluation given that the estimates from these models do provide economic value and provide additional information concerning the fixed income exposure of the fund that the Carhart model is unable to provide.

6. Relationship Between Hybrid Fund Cash Flows and Abnormal Return Estimates

Our main result thus far is that extended forms of the Carhart model designed to control for fund fixed income exposure provide significantly different conclusions about the abnormal performance of the funds relative to the original model. These results lead us to explore two final issues. First, is there evidence that cash flows into hybrid funds are related to past measures of abnormal performance? The academic literature on equity fund cash flows indicates that investors chase past positive abnormal returns (see for example Gruber 1996; Chevalier and Ellison 1997; Sirri and Tufano 1998; DelGuercio and Tkac 2002). If hybrid fund investors behave in a similar manner, then the differences in our abnormal performance measures raise the issue of whether investors are properly controlling for fund fixed income exposure in their investment decisions. Thus, we want to examine which model's abnormal performance measures drives the future investment dollars of investors.

Within each sample, we use the quarterly alphas from the Carhart and Carhart maturity models in order to examine these issues.[18] Each quarter, we sort the funds into the following four groups based on their alpha during the quarter: 1) both alpha measures are negative, 2) negative Carhart alpha, positive C-maturity alpha, 3) positive Carhart alpha, negative C-maturity alpha, and 4) both alpha measures are positive. Then, for each quarter, we define the new quarterly cash flow to each fund during the subsequent quarter as follows:

$$cf_{p,q} = tna_{p,q} - tna_{p,q-1}\left(1 + r_{p,q}\right) \tag{7}$$

where *cf* represents cash flow to fund *p* during quarter *q*, *tna* represents total net assets, and *r* represents the quarterly holding period return of the fund. We focus on total rather than percentage cash flows to a fund given that we are interested in which performance measure drives the total investment dollars into hybrid funds.[19] Each quarter, we average the new quarterly cash flow across funds within each group and then average the time series of cash flows for each group.

Results are reported in Table 9. To test for evidence that investors chase the past positive abnormal performance of hybrid funds with their investment dollars, we calculate the difference in average cash flows between Group 4 (both measures positive) and Group 1 (both measures negative). A positive difference between the groups suggests that new cash flows are related to measures of abnormal performance.

The results indicate a strong relationship between performance and cash flows. For the 1994 sample, quarterly cash flows are negative for both groups, but on average $12.1 million less is being withdrawn from funds with past positive abnormal performance than those with negative past performance. For the 2001 sample, quarterly cash flows are positive for both groups, and $35.6 million more is being invested in funds with positive performance. Both differences are significant at the five percent level. We are not concerned with the different signs of the average new cash flow across samples since Investment Company Institute data indicates that overall cash flow into hybrid funds was negative over the 1994-2000 period while it was positive during the more recent period. Thus, we are more concerned with the relative rather than absolute relationship between the groups.

Given the evidence that investors behave as if they chase past performance, we examine which performance measure drives the future investment dollars. We calculate the difference in average cash flows between Group 3 (Carhart positive, C-maturity negative) and Group 2 (Carhart negative, C-maturity positive) since risk adjusted performance differs for the funds included in these two groups.

The results provide strong evidence that investors are using the Carhart measure as the basis for their investment decisions. Across both samples, differences are positive and significant at the 5% level. For the 1994 sample, the difference in quarterly new cash flows between groups is $10.7 million. Group 3 is the only group with a positive cash inflow of $0.17 million as investors are placing money in funds that have a positive annualized Carhart alpha of 0.27% but a negative C-maturity alpha of -3.95%. Conversely, investors are withdrawing an average of $10.5 million from funds with a negative Carhart alpha of -2.97% but which are performing well on a risk adjusted basis when accounting for their fixed income exposure as measured by the C-maturity alpha of 4.01%. Similar results hold for the 2001 sample. We find $5.02 million more is being invested in funds within Group 3 than Group 2 although the C-maturity alphas indicate that Group 2 funds are outperforming Group 3 funds on a risk adjusted basis (2.12% vs. -1.93%).

This final set of results emphasize the importance of controlling for fixed income exposure in performance evaluation given that investors are placing substantial amounts of cash into funds that have negative rather than positive risk adjusted performance according to models specifically designed to control for the fixed income exposure of the fund.

7. Conclusion

A study of portfolio data provided by Morningstar indicates that fixed income securities compose a nontrivial portion of mutual funds holdings across all major classifications of mutual funds. This raises the following issue which is the focus of our study: does the Carhart model sufficiently account for the returns from various fixed income securities so that conclusions drawn in performance evaluation are not sensitive to the percentage, credit quality, or average maturity of fixed income holdings within a mutual fund's portfolio?

In this study, we specifically focus on hybrid funds which hold a substantial amount of fixed income securities within their portfolios. Despite their growth in popularity, the performance of these funds has received little attention in the academic literature. We use daily return data to measure the abnormal return of two samples of hybrid funds. First, we estimate performance using the Carhart (1997) four factor model and then reestimate performance using two extensions of the model that we believe are appropriate to measure the performance of funds that hold both stocks and bonds. We measure abnormal performance as the fund's alpha and by using a measure proposed by Bollen and Busse (2004) which combines both the manager's asset selection and market timing performance.

We find that the Carhart model inadequately explains fixed income returns, particularly over the period 2001-2005. As a result, we find that the extended forms of the model that include a fully specified bond index model for the bond portion of the fund provide substantially different conclusions concerning the abnormal performance of the funds. Specifically, there is an improvement in the estimated performance of our sample that covers March 1994 to December 2000. In the sample that spans January 2001 to June 2005, performance is positive according to the Carhart model, but is negative and statistically significant according to the extended models. Qualitatively similar results also hold for a separate sample of 230 equity funds that report nonzero bond holdings, and additional tests reinforce that the difference in alpha estimates across the Carhart and extended Carhart models is simply a function of a fund's bond holdings.

These results lead us to examine whether investors are properly controlling for fixed income exposure in their investment decisions. Our additional tests indicate that investors who use a fund's Carhart alpha as the basis for investment decisions are being clearly mislead, as significantly more investment dollars remain in or are added to funds with positive Carhart alphas and negative extended model alphas than to funds with the opposite performance measures.

Overall, the results of our study emphasize the importance of controlling for fixed income exposure and motivate the use of bond indices in performance evaluation when portfolio data indicate that funds hold a substantial proportion of fixed income securities. These results are of particular importance given the evidence that both equity and hybrid fund investors direct cash flows to funds based on risk adjusted measures.

[1] Among the papers that 1) examine either the asset selection ability and/or market timing skill of mutual funds, 2) include hybrids as part of the overall fund sample, and 3) do not explicitly include bond factors or indices as part of the fund benchmark are studies by Treynor and Mazuy (1966), Kon (1983), Chang and Lewellen (1984), Henriksson (1984), Lee and Rahman (1990), Edelen (1999), and Wermers (2000). Exceptions include Ferson and Schadt (1996) and Goetzmann, Ingersoll, and Ivkovic (2000) who include two bond indices as part of their benchmark while Aragon (2004) explicitly examines hybrids but only includes the Lehman US Aggregate Index as part of the benchmark. The only published study to exclusively focus on hybrid funds is Comer (2006).

[2] This estimated abnormal return is based on monthly return data over the previous three years.

[3] As discussed in the text, we focus on hybrid funds given that the academic literature typically ignores the bond portion of the fund. But as a robustness test of our results, we do create a sample of equity funds that report nonzero bond holdings over the 2001-2005 period and we report these results in a footnote in the empirical section.

[4] It should be noted that an alternative source of fund return data over this specific time period is *Standard & Poor's Micropal.* However, S&P receives its data from the same source as Bloomberg, and the return data suffers from the same problems discussed in the text.

[5] Morningstar classifications are based on actual investment styles as measured by the most recently reported portfolios holdings of the funds. The holdings may have been reported to Morningstar voluntarily or may have been taken from the semiannual and annual reports filed by the fund.

[6] For funds in the second sample, end of 2005 data is based on data reported as of the end of the second quarter.

[7] We use the December 31, 2004 Morningstar CD period to obtain an annual history of the reported fixed income style for a fund, if reported. We assign a value of one for each annual short maturity classification, a value of two for each intermediate classification, and a value of three for each long maturity classification. Using the time series of available classifications, we calculate an average maturity style for each fund. Funds with values less than 1.5 are classified as short, funds with values between 1.5 and 2.5 are classified as intermediate, and funds with values greater than 2.5 are classified as long maturity funds.

[8] Boney, Comer, and Kelly (2006) examine the maturity timing ability of fixed income managers and use a similar model which explains a significant percentage of the returns generated by high quality bond fund managers.

[9] We use the Gauss Newton method to obtain parameter estimates that minimize the objective function. Statistical significance of the estimates is based on *t* tests that use the estimated standard error of the coefficient estimates. The tests are valid asymptotically.

[10] The zero loading on the credit index can be traced to the high correlation (0.91) between the government and credit indices during the earlier sample period. The government index captures the entire investment across the two sectors.

[11] One issue that we do not explore in this study is the reason for the change in the relationship between the returns of the bond indices and the returns of the Carhart factors. A potential explanation lies in the fact that the Carhart model is not well suited for explaining the variation in bond returns. The r-squareds of the regressions across both time periods range from .025 to .108. Thus, the alphas appear to reflect the relative performance of stocks and bonds. During the 1994-2000 period, stocks outperformed bonds. Over the 2001-2005 period, bonds outperformed stocks.

[12] Although not reported, results for a separate sample of 230 equity funds that report nonzero bond holdings as of the December 31, 2000 are qualitatively similar. The use of the Carhart sector model results in an average decline of 0.25% in the abnormal return estimates of the funds. 67% of the fund alphas from the extended sector model are either the same or lower than their corresponding Carhart estimates. In addition, the results are similar whether one is comparing the Carhart alphas to the Carhart-maturity model. Additional details are available upon request.

[13] Our choice of one lag is based on Busse (1999) who uses daily return data and the Carhart model to examine volatility timing in mutual funds. He finds that the use of one lag for each factor is sufficient to control for any potential estimation problems related to nonsynchronous trading.

[14] There are two potential reasons we do not find a substantial impact from stale pricing. First, based on the semiannual reports, the portfolios of the hybrid funds in our samples tend to be well diversified and very liquid so that funds can easily sell securities to meet unexpected redemptions. Second, funds are allowed to estimate and report the fair value of their holdings to reduce valuation problems due to infrequently traded securities.

[15] As a specific example, the Vanguard Asset Allocation fund is part of our fund sample and is one of the few funds that provides detailed information about fund allocation strategy. In the prospectus, this fund explicitly states that it uses an indexing strategy within the three major asset classes of stocks, bonds, and cash, but changes allocations to

the classes based on their financial models. Thus this fund does not engage in any asset selection and focuses strictly on market timing/tactical asset allocation.

[16] Another popular timing model specification is that of Henriksson and Merton (1981). However, no published study has shown how the model works for funds that time across multiple asset classes. Thus, we do not include this specification in this study.

[17] Our use of daily return data provides us with a sufficient number of observations to use the same quarterly measurement interval employed by Bollen and Busse (2004) in their study of the short term persistence in the performance of equity mutual funds.

[18] Throughout the paper, we have noted the close relationship between extended model results, particularly the alphas. For this test, we also find that the results using the Carhart sector model and the BB measure are virtually identical and for the sake of clarity and brevity we do not report them in this section.

[19] For the 2001 sample, all results that follow hold regardless of whether one uses total or percentage cash flows.

References

Aragon, G., 2004, "Timing Multiple Markets: Theory and Evidence from Balanced Mutual Funds," working paper.

Blake, C., E. Elton, and M. Gruber, 1993, "The Performance of Bond Mutual Funds," *Journal of Business*, 66, 371-403.

Bollen, N., and J. Busse, 2001, "On the Timing Ability of Mutual Fund Managers," *Journal of Finance*, 56, 1075-1094.

Bollen, N., and J. Busse, 2004, "Short Term Persistence in Mutual Fund Performance," *Review of Financial Studies*, 18, 569-597.

Boney, V., G. Comer, and L. Kelly, 2006, "Timing the Investment Grade Securities Market: Evidence from High Quality Bond Funds," working paper.

Busse, J., 1999, "Volatility Timing in Mutual Funds: Evidence from Daily Returns," *Review of Financial Studies*, 12, 1009-1041.

Carhart, M., 1997, "On Persistence in Mutual Fund Performance," *Journal of Finance*, 52, 57-82.

Chang, E. and W. Lewellen, 1984, "Market Timing and Mutual Fund Investment Performance," *Journal of Business*, 57, 57-72.

Chevalier, J. and G. Ellison, 1997, "Risk Taking by Mutual Funds as a Response to Incentives," *Journal of Political Economy*, 105, 1167-1200.

Comer, G., 2006, "Hybrid Mutual Funds and Market Timing Performance," *Journal of Business*, 79, 771-797.

Del Guercio, D. and P. Tkac, 2002, "The Determinants of the Flow of Funds of Managed Portfolios: Mutual Funds vs. Pension Funds," *Journal of Financial and Quantitative Analysis*, 37, 523-557.

Dimson, E., 1979, "Risk Measurement When Shares Are Subject to Infrequent Trading," *Journal of Financial Economics,* 7, 197-226.

Edelen, R., 1999, "Investor Flows and the Assessed Performance of Open-ended Mutual Funds," *Journal of Financial Economics,* 53, 439-466.

Elton, E., M. Gruber, S. Das, and M. Hlavka, 1993, "Efficiency with Costly Information: A Reinterpretation of Evidence from Managed Portfolios," *Review of Financial Studies,* 6, 1-22.

Fama, E., and K. French, 1993, "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics,* 33, 3-56.

Ferson, W., T. Henry, and D. Kisgen, 2005, "Evaluating Government Bond Fund Performance with Stochastic Discount Factors," forthcoming *Review of Financial Studies*.

Ferson, W. and R. Schadt, 1996, "Measuring Fund Strategy and Performance in Changing Economic Conditions," *Journal of Finance,* 51, 425-461.

Glassman, D. and L. Riddick, 2004, "Market Timing by Global Fund Managers," forthcoming *Journal of International Money and Finance*.

Goetzmann, W., J. Ingersoll, and Z. Ivkovic, 2000, "Monthly Measurement of Daily Timers," *Journal of Financial and Quantitative Analysis,* 35, 257-290.

Gruber, M., 1996, "Another Puzzle: The Growth of Actively Managed Mutual Funds," *Journal of Finance,* 51, 783-810.

Henriksson, R., 1984, "Market Timing and Mutual Fund Performance: An Empirical Investigation," *Journal of Business,* 57, 73-96.

Henriksson, R. and R. Merton, 1981, "On Market Timing and Investment Performance," *Journal of Business,* 54, 513-533.

Kon, S., 1983, "The Market-timing Performance of Mutual Fund Managers," *Journal of Business,* 56, 323-347.

Kosowski, R., 2002, "Do Mutual Funds Perform When It Matters Most to Investors? US Mutual Fund Performance and Risk in Recessions and Booms 1962-2000," working paper, INSEAD.

Kothari, S.P., and J. Warner, 2001, "Evaluating Mutual Fund Performance," *Journal of Finance,* 49, 1985-2010.

Lee, C. and S. Rahman, 1990, "Market Timing, Selectivity, and Mutual Fund Performance: An Empirical Investigation," *Journal of Business,* 63, 261-278.

Sharpe, W., 1964, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *Journal of Finance,* 19, 452-542.

Sharpe, W., 1992, "Asset Allocation: Management Style and Performance Measurement," *Journal of Portfolio Management,* 18, 7-19.

Sirri, E. and P. Tufano, 1998, "Costly Search and Mutual Fund Flows," *Journal of Finance,* 53, 1589-1622.

Treynor, J. and K. Mazuy, 1966, "Can Mutual Funds Outguess the Market?" *Harvard Business Review*, 131-136.

Wermers, R., 2000, "Mutual Fund Performance: An Empirical Decomposition into Stock-picking Talent, Style, Transactions Costs, and Expenses," *Journal of Finance,* 55, 1655-1695.

Table 1
Descriptive Statistics of Hybrid Fund Samples

	1994 Sample	**2001 Sample**
Number of Funds	132	263
Average Total Net Assets	981.1 million	1017.4 million
Median Total Net Assets	149.5 million	124.3 million
Stock Allocation	56.9%	59.2%
Bond Allocation	29.8%	29.5%
Cash Allocation	8.7%	6.2%
Other Allocation	4.6%	5.1%
Portfolio Turnover	98.7%	91.8%
Expense Ratio	1.14%	1.04%

The table presents descriptive statistics for the two samples of hybrid funds. The first sample covers the time period March 1, 1994 to December 31, 2000, while the second sample cover the period January 1, 2001 to June 30, 2005. All values are averages across all funds in the sample. To obtain averages, we first averaged the time series data of each fund and then averaged across funds. Data are from CRSP and represent annual year end values.

Table 2
Sharpe Quadratic Programming Technique

	Carhart Sector Model	
	1994 Sample	**2001 Sample**
Market	56.7***	55.1***
Size	-3.1***	-1.1***
Book to Market	9.5***	4.2***
Momentum	-3.8***	2.4***
Government	25.3***	13.3***
Credit	0	10.3***
Mortgage	4.2***	8.7***
High Yield	2.3*	1.8***
Cash	11.5***	10.7***
Adjusted r-square	.984	.994
	Carhart Maturity Model	
	1994 Sample	**2001 Sample**
Market	56.6***	55.2***
Size	-3.1***	-1.1***
Book to Market	9.4***	4.3***
Momentum	-3.8***	2.4***
Intermediate	20.6***	19.8***
Long	5.6***	5.0***
Mortgage	4.2***	8.4***
High Yield	1.5*	1.8***
Cash	11.5***	9.7***
Adjusted r-square	.984	.993

The table presents results from the Sharpe quadratic portfolio technique that is used to estimate the average percentage of assets that each fund sample has allocated to the factors included in the Carhart sector and Carhart maturity models. For each fund sample, the return on an equally weighted portfolio of all funds in existence is calculated. This return is regressed against the returns on the factors listed in the table. In the estimation, the coefficient of the Carhart market factor, the coefficients of the bond indices, and the coefficient of the cash index are constrained to be between zero and one and the sum of those coefficients must equal one. The size, book to market, and momentum factors represent zero investment portfolios and thus their coefficients are not constrained to be positive. Each coefficient estimate represents the average percentage of assets allocated to each factor/strategy. *** represents statistical significance at the one percent level, while ** and * represent significance at five percent and ten percent respectively.

Table 3
Estimated Abnormal Return for Various Bond Indices Relative to the Carhart Model

Bond Index	1994-2000 Abnormal Return	2001-2005 Abnormal Return
Credit	-1.05%	7.63%**
Government	-0.40%	6.39%**
Intermediate	-0.25%	6.23%**
Long	-1.42%	9.57%**
Mortgage	0.20%	6.01%**
High Yield	-5.27%**	8.86%**

The table presents the results of the regression of each of the daily bond return indices listed in the table against the Carhart four factor model. The abnormal return is represented by the alpha from the regressions. The daily alpha estimates have been annualized and the annualized values are presented in the table. ** denotes statistical significance at the five percent level.

Table 4
Estimated Abnormal Return for Various Bond Indices Relative to the Carhart Model and Lehman Aggregate Bond Index

Bond index	1994-2000 abnormal return	2001-2005 abnormal return
Credit	-0.53%	0.05%
Government	0.03%	-0.98%***
Mortgage	0.54%	0.92%**
Intermediate	0.05%	0.23%
Long	-0.58%	-2.42%**
High yield	0.31%	5.80%***

The table presents the results of the regression of the excess returns of each of the daily bond return indices listed in the table against the Carhart model with the Lehman Aggregate Bond Index as an additional independent variable. The abnormal return is represented by the alpha from the regressions. The daily alpha estimates have been annualized and the annualized values are presented in the table. *** denotes statistical significance at the one percent level while ** reflects significance at the five percent level.

Table 5
Comparison of Alpha Across Carhart Models

1994 Sample			
	Carhart Model	**C-Maturity Model**	**C-Sector Model**
Avg alpha equal weighted portfolio	-1.501%**	-1.252%**	-1.263%**
Positive alphas	27	31	27
Negative alphas	105	101	105
Positive and significant alphas	3	5	4
Negative and significant alphas	27	31	31
Alpha improved relative to Carhart model		82	70
Alpha unchanged from Carhart model		35	49
Alpha declined relative to Carhart model		15	13
2001 Sample			
	Carhart Model	**C-Maturity Model**	**C-Sector Model**
Avg alpha equal weighted portfolio	0.082%	-1.524%**	-1.501%**
Positive alphas	127	29	36
Negative alphas	136	234	227
Positive and significant alphas	12	4	5
Negative and significant alphas	14	94	89
Alpha improved relative to Carhart model		2	3
Alpha unchanged from Carhart model		3	2
Alpha declined relative to Carhart model		258	258

The table reports the cross section of estimated abnormal returns as measured by alpha for both the 1994 and 2001 samples when using the Carhart, Carhart-maturity, and Carhart-sector models. The daily alpha estimates reported in the table have been annualized. For the Carhart model, each fund's excess return is regressed against the four factors of the Carhart model. For the Carhart maturity model, each fund's excess return is regressed against the four factors of the Carhart model and the following four bond indices: intermediate bond, long bond, mortgage, and high yield. For the Carhart sector model, the excess return is regressed against the four factors of the Carhart model and the following four bond indices: credit, government, mortgage, and high yield. Alpha is represented by the value of the intercept of the regressions. The average alpha is based on the regression of the excess returns of an equal weighted portfolio of all funds with the sample. The statistical significance of individual fund timing coefficients is based on heteroskedasticity consistent standard errors. ** represents statistical significance at the five percent level.

Table 6
Comparison of Abnormal Returns Across Specifications

	1994 Sample	2001 Sample
Carhart alpha	-1.501%**	0.082%
Carhart BB	-1.445%**	0.122%
C-maturity alpha	-1.252%**	-1.524%**
C-maturity BB	-1.355%**	-1.635%**
C-sector alpha	-1.263%**	-1.501%**
C-sector BB	-1.353%**	-1.575%**

The table reports the estimated abnormal returns as measured by alpha and the Bollen and Busse (BB) measure for both the 1994 and 2001 samples when using the Carhart, Carhart-maturity, and Carhart-sector models. The reported abnormal returns are based on a regression of the excess returns of an equal weighted portfolio of all funds with the sample. For the Carhart model, fund excess return is regressed against the four factors of the Carhart model. For the Carhart maturity model, fund excess return is regressed against the four factors of the Carhart model and the following four bond indices: intermediate bond, long bond, mortgage, and high yield. For the Carhart sector model, the excess return is regressed against the four factors of the Carhart model and the following four bond indices: credit, government, mortgage, and high yield. Alpha represents the value of the intercept of the regressions. For the BB measure, each of the three Carhart models is supplemented with a quadratic term representing the square of the market return. The BB measure is then computed as detailed in equation (7) in the text which considers both asset selection and market timing skill. The statistical significance of the coefficients is based on heteroskedasticity consistent standard errors. ** represents statistical significance at the five percent level.

Table 7
Forecasting Performance of Extended Carhart Model Alphas

	1994 Sample		2001 Sample	
Decile	**C-Maturity Model Alpha**	**C-Sector Model Alpha**	**C-Maturity Model Alpha**	**C-Sector Model Alpha**
1 (worst alpha)	-4.24%	-4.15%	-2.95%	-3.04%
2	-2.47%	-2.36%	-2.76%	-2.87%
3	-1.66%	-1.74%	-2.48%	-2.91%
4	-2.62%	-2.58%	-2.40%	-2.44%
5	-2.36%	-2.29%	-2.00%	-2.07%
6	-1.84%	-1.64%	-1.67%	-1.87%
7	-2.13%	-2.18%	-1.91%	-1.86%
8	-1.70%	-1.59%	-1.26%	-1.37%
9	-1.36%	-1.51%	-1.57%	-1.42%
10 (best alpha)	-0.86%	-0.83%	0.26%	-0.08%
Best decile minus worst decile	3.38%***	3.32%***	3.20%***	2.96%***
Spearman Rank Coefficient	0.782***	0.879***	0.976***	0.976***

The table shows the average annual realized alpha for quarterly holding periods where the deciles were formed based on the ranking criteria shown at the top of the column. For each fund, we use the Carhart maturity and C-sector models to calculate alpha on a quarterly basis for each quarter the fund is in existence. Then, at the end of each quarter, the funds are ranked and placed into deciles based on the funds' alpha during the quarter. Then, for each fund within a specific decile, we estimate the fund's alpha for the subsequent quarter. Each quarter, we average the individual alphas within a specific decile, and then we average the time series of alphas for each decile which is the value reported in the table. *** reflect statistical significance at the one percent level.

Table 8
Forecasting Performance of Bond Factor Loadings from the Extended Carhart Models

1994 Sample								
	C-Maturity Model				**C-Sector Model**			
Decile	**Intermediate**	**Long**	**Mortgage**	**High Yield**	**Government**	**Corporate**	**Mortgage**	**High Yield**
1 (lowest)	0.099	-0.039	0.066	0.005	-0.134	0.006	0.056	0.003
2	0.136	0.033	0.114	0.005	-0.103	0.101	0.072	0.005
3	0.187	0.022	0.061	0.014	0.055	0.137	0.053	0.010
4	0.140	0.049	0.089	0.017	0.083	0.174	0.095	0.013
5	0.252	0.044	0.074	0.021	0.165	0.213	0.095	0.017
6	0.185	0.040	0.115	0.029	0.116	0.240	0.109	0.028
7	0.223	0.050	0.093	0.030	0.204	0.210	0.106	0.032
8	0.142	0.052	0.120	0.038	0.172	0.206	0.114	0.043
9	0.251	0.072	0.184	0.046	0.232	0.206	0.156	0.048
10 (highest)	0.391	0.146	0.272	0.062	0.455	0.266	0.186	0.079
Spearman Coefficient	0.733***	0.939***	0.818***	1.000***	0.976***	0.770**	0.939***	1.000***

2001 Sample								
	C-Maturity Model				**C-Sector Model**			
Decile	**Intermediate**	**Long**	**Mortgage**	**High Yield**	**Government**	**Corporate**	**Mortgage**	**High Yield**
1 (lowest)	0.126	0.027	0.046	0.001	-0.146	0.034	-0.014	0.010
2	0.105	0.024	0.077	0.005	-0.047	0.044	0.006	0.005
3	0.154	0.032	0.046	0.007	-0.013	0.081	0.091	0.014
4	0.168	0.038	0.101	0.009	0.070	0.062	0.055	0.025
5	0.189	0.050	0.071	0.012	0.069	0.109	0.097	0.030
6	0.143	0.050	0.103	0.026	0.103	0.123	0.114	0.027
7	0.215	0.056	0.120	0.033	0.176	0.147	0.156	0.026
8	0.190	0.059	0.109	0.048	0.166	0.164	0.133	0.027
9	0.224	0.065	0.128	0.050	0.204	0.206	0.173	0.034
10 (highest)	0.211	0.138	0.101	0.095	0.441	0.226	0.147	0.075
Spearman Coefficient	0.854***	0.988***	0.709**	1.000***	0.976***	0.988***	0.927***	0.903***

The table shows the average quarterly bond factor loadings for quarterly holding periods where the deciles were formed based on the ranking criteria shown at the top of the column. For each fund, we use the C-maturity and C-sector models to calculate the bond factor loadings on a quarterly basis for each quarter the fund is in existence. Then, at the end of each quarter, the funds are ranked and placed into deciles based on each fund's bond factor loading during the quarter. Then, for each fund within a specific decile, we estimate the fund's loading for the subsequent quarter. Each quarter, we average the loadings within a specific decile, and then we average the time series of loadings for each decile which is the value reported in the table. *** reflect statistical significance at the one percent level.

Table 9
Relationship Between Abnormal Return Estimates and Subsequent Cash Flows

1994 Sample						
Group	**Carhart Alpha**	**C-Maturity Alpha**	**Cash Flow**	**# of Observations**	**Annualized Carhart Alpha**	**Annualized C-Maturity Alpha**
1	Negative	Negative	-13.44	62	-7.04%	-7.98%
2	Negative	Positive	-10.53	16	-2.97%	4.01%
3	Positive	Negative	0.17	14	0.27%	-3.95%
4	Positive	Positive	-1.30	32	5.75%	7.60%
Cash flow: Group 4 – Group 1		12.14**				
Cash flow: Group 3 – Group 2		10.70**				
2001 Sample						
Group	**Carhart Alpha**	**C-Maturity Alpha**	**Cash Flow**	**# of Observations**	**Annualized Carhart Alpha**	**Annualized C-Maturity Alpha**
1	Negative	Negative	0.88	115	-4.73%	-5.78%
2	Negative	Positive	3.03	19	-2.01%	2.12%
3	Positive	Negative	8.05	54	1.91%	-1.93%
4	Positive	Positive	36.51	61	5.80%	4.95%
Cash flow: Group 4 – Group 1		35.63**				
Cash flow: Group 3 – Group 2		5.02**				

The table presents the relationship between abnormal return estimates and subsequent cash flows into the funds. For each fund, we use the Carhart and C-maturity models to calculate alpha on a quarterly basis for each quarter the fund is in existence. Each quarter, we sort the funds into the following four groups based on their alpha during the quarter: 1) both alpha measures are negative, 2) negative Carhart alpha, positive C-maturity alpha, 3) positive Carhart alpha, negative C-maturity alpha, and 4) both alpha measures are positive. Then, for each quarter, we define the new quarterly cash flow to each fund during the subsequent quarter as the change in total net asset value minus the appreciation in fund assets. Each quarter, we average the new quarterly cash flow across funds within each group and then average the time series of cash flows across groups. The number of observations, annualized Carhart alpha, and annualized C-maturity alpha also reflect the average of the time series across groups. Cash flow is measured in millions of dollars. ** denotes significant differences in the average cash flow across groups at the five percent level.